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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

The Thirty-First Annual Meeting of the New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Feb. 13, 1901.

To the Members of the New England Association of Gas Engineers: The thirty-first annual meeting of this Association will be held at Young's Hotel, Boston, Mass, on Tuesday and Wednesday, February 19th and 20th, 1901—note change of opening day from Wednesday to Tuesday. The meeting will convene in room 12, at 10 o'clock, A.M., Tuesday, and members are requested to gather promptly, as the time of the meeting promises to be fully occupied. The following papers are promised for reading:

"Remarks on Purification;" by Mr. S. J. Fowler, Springfield, Mass.

"The Proportion of Sulphur Removed in Each Purifying Box;" by Mr. Carroll Miller, Newark, N. J.

"Some Sketches of Gas Governors;" by Mr. J. J. Humphreys, Jr., Worcester, Mass.

"Selling Gas;" by Mr. C. J. R. Humphreys, Lawrence, Mass.

"A Test of a Gas Engine Electric Lighting Plant;" by Mr. H. N. Cheney, Boston, Mass.

"How They Do Things on the Other Side;" by Mr. F. H. Shelton, Philadelphia, Pa.

"Gas Lighting at the Paris Exposition;" by Mr. Walter S. Allen, New Bedford Mass.

Reports on "Inclined Retorts" and "Coke Ovens" up to-date will be discussed, as well as "Gas Handling Plants," "Assisting Purification by Adding Oxygen," etc., etc.

The following questions have been sent for the Question Box:

"Is the use of the prepayment meter increasing; and does it pay?"

"What is the proper size of mesh in coke screens through which the breeze should pass?"

"In coal gas manufacture, does it pay to work for highest yield; or should greatest number of candle feet be sought for?"

"What is the average boiler fuel for 1,000 cubic feet of coal gas made?"

"Which system of tar scrubbing is more approved: (a) by means of perforated plates or baffles, as in apparatus of the P. & A. type; or (b), by means of a succession of water seals, as in apparatus of which the Walker tar extractor is a type?"

"Are incandescent gas lights being used anywhere in cotton mills with success?"

"Is the incandescent gas burner in sufficiently general use to warrant a reduction in illuminating power to, say, 17 candles?"

"How best to run an exhauster with a gas engine?"

Members may obtain badges from the Secretary. The annual dinner will be held Tuesday evening instead of Wednesday. Application blanks for membership may be obtained of the Secretary, and all matters to come before the Directors should be in the Secretary's hands before February 18th. Annual dues should be remitted before the meeting.

Friends of the Association are cordially invited to attend the meeting.

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Eighth Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ANN ARBOR, MICH, Jan. 28, 1901.

To the Members of the Michigan Gas Association: The eighth annual meeting of the Michigan Gas Association will be held in Grand Rapids,

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Mich., on Wednesday and Thursday, February 20th and 21st. The headquarters will be in the Morton House, where the meetings will also be held.

The following papers will be presented :

"Neglected Opportunities ;" by Mr. B. C. Cobb, Detroit, Mich.

"Inclosed Cluster Lights with Self-Igniters ;" by Mr. A. L. Zwisler, Kalamazoo, Mich.

"Street Maps : Their Use and Abuse ;" by Mr. Paul Challis, Adrian, Mich.

"New Business ;" by Mr. J. C. Sloan, Port Huron, Mich.

"The Relation of Heating and Illuminating Gases, Especially as Applied to Incandescent Mantles ;" by Mr. Herman Russell—Mr. Russell is the bearer of the Michigan Gas Association Scholarship in the University of Michigan.

A number of short topics will also be offered and discussed.

The rates secured by the committee having the matter in charge, for the accommodation of the members and the Association's guests at the Morton House, are : $2.50, $3 and $3.50 per day—the last rate affording a room and bath. The best accommodations are always secured by writing in advance. HENRY W. DOUGLAS, Secretary.

BRIEFLY TOLD.

AN EXCEEDING AFFLICTION.—Tragic and sorrowful indeed was the news which came to New York by international cable the morning of last Tuesday. The fateful message told of the death of the sons of Mr. Alexander C. Humphreys, who were drowned in the Nile river, presumably at a point close to Luxor, which to-day stands as a relic of or memento to the glories of bygone Thebes. The news that we have of the misfortune is indefinite, but enough is known to realize that Mr. Humphreys' two sons (Harold, aged 24, and Alexander Crombie, aged 6) came to their death in the stream whose queer flow has often puzzled the world, perhaps oftener in the past than now. The Humphreys family (Mr. and Mrs. A. C. Humphreys, Harold Humphreys and his wife—to whom he had been only wedded last summer—and Alexander Crombie Humphreys, Jr.), were enjoying a holiday in Europe, and in that light the horrible happening is all the darker. The information at hand respecting the disaster is too meager to warrant any recital of details, which will follow soon enough, now that the worst is known. Mr. Harold Humphreys was a graduate of the Stevens Institute of Technology (Class of 1899), and since his graduation had been engaged with his father, in the service of Messrs. Humphreys & Glasgow, of New York and London. The misery of this awful happening is beyond recital, and to the afflicted ones may we hope they will bravely bear their cross. If sympathy and sorrow will lighten their grievious burden, then such they know they have in unstinted measure.

THE YEAR BOOK OF THE AMERICAN GAS LIGHT ASSOCIATION.—We are in receipt of a copy of Volume XVII., which contains the "Proceedings of the American Gas Light Association," as prepared for the members respecting the 28th annual meeting of the Association, held in Denver last October, under the Presidency of Mr. George G. Ramsdell, and the direction of the Secretary, Mr. A. E. Forstall. The title page of the book carries the imprint December, 1900 ; but we did not get our complimentary copy of it until last week. It is well printed and well bound, and we have no doubt it will be read with about as much interest as any of those publications usually are. A particularly well done photograph of President Ramsdell is a feature of the "Proceedings."

NOTES.—The proprietors of the Pittsfield (Mass.) Coal Gas Company have awarded a contract to the American Gas Company, of Philadelphia, for the construction of a complete coal gas plant. The works are to be erected on the site owned by the Pittsfield folks directly on the line of the Boston & Albany Railroad. The ultimate capacity of the plant is fixed at a per diem output of 500,000 cubic feet, and the plans call for the building of a holder up to the retaining of 250,000 cubic feet. The benches are to be of the Kloenne-Bredel pattern. In fact, no expense is to be spared by the Pittsfield Company in equipping itself for the business that has come to it through the growth of its district. The final expenditure to the Pittsfield Company will be well over $100,000 which includes the cost of important street main renewals and extensions.——Write to the William M. Crane Company, 1131 to 1133 Broadway, N. Y., for a copy of its handsome catalogue, in which is detailed a lot of useful information respecting its appliances and apparatus for the use of gas for purposes other than lighting. The number of the catalogue is 19, and the Company will forward it on application.——Mr. C. H. Welch has resigned the position of President and Manager to the Athens (O.) Gas Light and Electric Company, and has disposed of a large part of his interest therein. He does not, however, intend to retire from gas trading, since he has made a good, round investment in the extensive natural gas field of southeastern Kansas, which buying included all the rights to the Coffeyville (Kas.) Gas Company and the gas territory adjacent to that Company's former field of operating. The purchase looks a good one, and Mr. Welch's friends will be well enough satisfied when they know that his successes in Coffeyville have exceeded those gained by him in Athens. Good luck to him.——The residents of Charleston, S. C., are growling loudly over the nature of the service and the quality of the gas they are receiving for pay.——The works of the Streator (Ills.) Gas and Light Company are being reconstructed. The Missouri Firebrick Company is furnishing the clay material for the rejuvenation, and the Kerr Murray Manufacturing Company is putting in the iron work.

OBITUARY NOTE.—MR. TROMAS K. LEES.

"J. D. P.", writing to the JOURNAL under date of New York, February 8th, forwards the following obituary note respecting Mr. Thomas K. Lees, late Vice-President of the Consolidated Gas Company, of this city :

The friends of Mr. Thomas K. Lees do not feel that the somewhat imperfect record of his life, in your issue of the 4th inst., does justice to the memory of a man who, for 40 years, had been intimately connected with the gas industry of New York.

Mr. Lees was born in Connecticut, October 31st, 1819. For nearly 20 years he was connected with one of the large mercantile houses in New Haven, and, upon the recommendation of one of his employers, interested in the New York Gas Company, he came to New York, in May 1861, to assume the Secretaryship of that Company ; Mr. John H. Adam was the then President, and Mr. C. L. Everett, Vice-President. Mr. Lees soon familiarized himself with the details of gas manufacture and, during the succeeding 10 years, became a most valuable assistant to President Adam. Upon the death of Mr. Adam, in 1871, Mr. Everett was promoted to the Presidency and Mr. Lees became the Vice-President of the Company. While Mr. Everett was nominally the President, the marking out of the policy of the Company and its execution devolved almost solely upon the Vice-President. Upon the death of Mr. Everett, in 1874, Mr. Lees succeeded to the Presidency of the Company. During the ten years which followed his assumption of the Presidency, his executive ability, financial training and rare foresight, as to everything pertaining to the gas industry of New York, enabled him to conduct the affairs of the Company with marked success. Some of the most remarkable developments in gas manufacture took place during this period, and were promptly availed of by him for the benefit of the Company whose interest had been placed in his hands. He did not claim to be a gas engineer, but he was in close touch with the progressive element among the fraternity and welcomed every movement looking to the advancement of the interests intrusted to him.

He was a man of strong convictions, ready at all times to avow them, and defend them when called upon to do so. He early foresaw the importance of the then recently introduced process of water gas manufacture; and, being convinced that the interests of his stockholders would be furthered by its application to the works under his direction, he caused his ideas to be put in practical effect, and in 1881 had transformed the old coal gas plant of his Company into the largest water gas works of the country. His action in this matter called forth some very sharp criticism from his nearest friends, but he lived to see his course justified and followed by nearly all the gas companies of the country.

Upon the consolidation of the several gas companies of this city, in 1884, he became the Consolidated Gas Company's First Vice President, which office he held until his decease.

He was an excellent judge of men, as evidenced in the character of those whom he selected as his assistants; with scarcely an exception these assistants now occupy most responsible positions in the gas companies of this city.

He was the trusted executor of the estate of former President Adam, and for 30 years carefully guarded the interests of the family of his friend, his care only ceasing with his death.

He was kind and considerate to his employees, amongst whom his loss is regretted as that of a near and dear friend. The esteem in which he was held by his associates in the Board of the Consolidated Gas Company was shown by their refusal to accept his resignation, which was tendered to them two years ago, when he felt that his active usefulness had ceased, and their retention of his name as Vice-President until his decease.

[Prepared for the JOURNAL.]

General Gas Works Machinery for the Philippines.

By MR. G. D. RICE.

Good Opening for Sale of Gas Apparatus.—Your correspondent recently visited several of the most important sections of the Philippine islands and gave particular attention to the prospects for the establishment of gas works in the leading commercial centers. The indications are that before the close of another year some good sales of gas works equipments will be made in these islands, for the reasons that the recent discoveries of the coal mines and the increasing demand for lights throughout the settled districts have all tended to develop the gas making business. The coal mine operators are now doing considerable mining, and, with the peace which has come to practically all portions of the islands, the miners have been able to work unmolested and the products of the mines are being shipped by native sailing craft to the different seaports for distribution. One may now secure coal from the domestic mines at Manilla, Iloilo and other leading ports, whereas a short while ago the only available coal supply was that furnished from other countries, which coal was sent here in carefully weighed bags, for the reason that every pound of the coal represented a high price. With the domestic mines turning out coal, which is as suitable for burning, for cooking, steam raising and gas making as the imported, the circumstances have greatly changed, and the market value of the coal is now down to reasonable figures so that the ordinary consumer can use it. The reduction of the prices on the coal and the increase in the production, due to the incoming of numbers of American, German, English and other miners, with considerable capital and machinery, have tended to encourage the introduction of gas works in Manila and in Iloilo. There are other points where the writer was informed by the officials that money would be subscribed

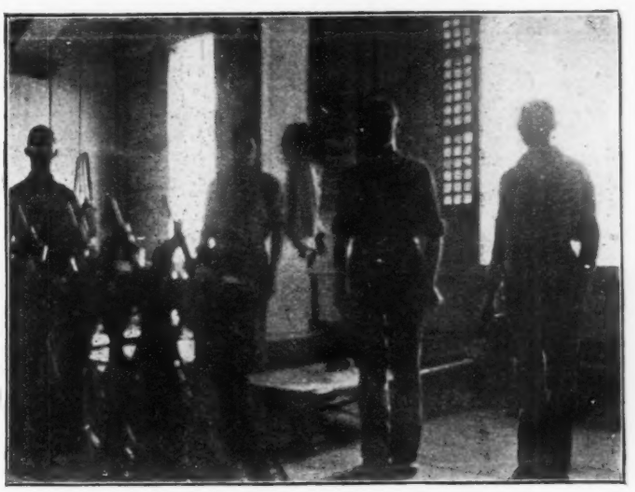
A Scene in the Philippines.

for stock for erection of gas works. The only actual attempts for the locating of gas works have been on the islands of Luzon, Panay, Cebue and Negros, where there are quite a number of American soldiers, among some of whom are former gas works machinists and others who were interested in gas making and distribution in the United States, and who would undertake to establish works here. I conversed with several enterprising men who told me that they would soon have gas works in operation at certain points. The demand for lights in the Philippines is constantly increasing, and the supplies of oil and other burning materials, such as candles, are not enough to meet the present requirements. I have been in rich towns which have been kept in darkness many a night due simply to the exhausted supply of petroleum oils or other materials for lighting purposes. The oil wells cannot begin to keep up with the demand for oils, and the imported supply is not ample. Therefore, the chances for the success of gas works, when once established, are exceedingly good.

Experimental Apparatus in Demand.—Experimental apparatus is in active request by parties who are interested in the establishing of gas works in the islands. Speaking with a number of gas engineers and others on the subject I found that some of them had sent considerable money to Spain and other countries, where they supposed that they could get experimenting apparatus sooner than if the orders were placed in America. Some of the orders which were sent to Hongkong resulted in the bringing of certain pieces of experimental apparatus here, but most of it is defective and not as good as the American patterns. Provers, registers, gauges, etc., are wanted and would bring good values here.

Gasholders.—The simplest forms of gasholders are of course required for use in these islands, for the help which the owners of the gas works would have, would undoubtedly be of the native sort, and these Filippinos are not natural mechanics. Great at tinkering, they will spend days trying to make a machine work, but often finish by breaking some important part. They are careless with their tools and do not seem to know how much strength metal will bear before breaking. They will twist off nuts and set-screws at a great rate, and one has to keep his eye on them constantly. Both single and telescopic forms of gasholders would evidently find sale here, and these should be provided with iron or steel tanks, for there is no sheet metal available in the iron markets of this country that can be relied upon. The manufacturers of sheet metal of other countries have had the habit of sending rejected pieces here for some years, and most of that which is on the market at the present time would not be suitable for building gasholders, tanks or kindred apparatus. There have been some agents here with models of single and multiple lift gasholders, complete, with steel or iron tanks, and I believe that some of the presidents of the larger cities in the southern islands of the archipelago, encouraged by the local commanding officers of troops, secured enough money to warrant the sending of plants here for use. The capacity of the holders which have thus far been ordered for use here is, I am told, 200,000 cubic feet each.

Oil Tanks.—Oil and water tanks should be sent along with the gas holders, and used for the purpose intended. There appears to be considerable demand for tanks of all kinds in the islands, for in several instances where tanks have been sent here for special purposes they



The American Guard in Quarters.

have been sold to the sugar mill people at greatly advanced values. One agent, who came here to represent a mining machinery concern, sold all of the tanks and kindred equipments, such as pumps, pipes, etc., which he brought for the miners, to persons engaged in other enterprises which called for the service of the same. Of course, this agent made a small fortune out of the supply he had, and he now has much more of the same stock on the way here. The condition of the islands has been so unsettled for so many years that every sort of industrial enterprise has been virtually permitted to go to ruin. Therefore, that peace is now here, and the proprietors can operate their works in safety, the request for all kinds of mechanical devices and equipments has come suddenly and is extensive.

Benches, scrubbers and condensers are going to be in good call in conjunction with other gas machinery equipments, and should not be overlooked. In fact it would pay gas machinery builders and supply houses to be represented here at Manila and at Iloilo.

Iron Roofing.—The requirements for iron roofing for gas works and for other buildings is very large in the Philippines, and manufacturers of this material would be surprised at the amount of business they could do in the metal if they maintained stocks in the islands. Certain rules established by the military officials declare that no more "nipe" or thatched roofs shall be put on buildings within certain limits of the cities and towns, and the result is that much of this inflammable material is being removed and sheet metal, corrugated stock employed. Spain has been in the habit of shipping corrugated thin metal stock here for many years, as the roofing obtained with it is light, fireproof and insect-proof, but the grade is inferior and in a short time the elements wreck the metal through corrosion and wear. If such

kinds of iron roofing as are employed in connection with gas works were sent here the business done would be encouraging to the dealers.

Purifiers, Etc.—Purifiers, self-sealing retort lids, and in fact all parts of gas works apparatus, will shortly be in demand in the islands as a result of the increased business being done in the way of establishing gas lights for the cities and towns. Contracts for complete works have been placed in some instances, and only the lack of machinery and supplies on the ground prevents immediate operations.

Hydraulic Mains.—Hydraulic mains should not be overlooked in the matter of furnishing supplies and machinery to the Philippines, for these are needed in the regular order. Condensers, scrubbers, valves, etc., should be kept in stock. As to the latter, the demand for these is increasing since the beginning of the operations in the water supply line (and in the locating of oil supply wells for furnishing illuminating oils) to the cities and towns from the reservoirs which are being put in at the works. The special types of valves wanted are double gate, hub and flange, outside screw and quick opening, 3 to 30 inches diameter. The shortage in piping and valves has hindered the progress of the work in many places, and your correspondent has observed many crude substitutes for hydrants, valves, gauges, etc. I saw some valves formed entirely from wood, with the stem and seat carved from the so-called bullet wood of the islands, which wood is almost as hard as iron. These wood valves serve the purpose well for about 6 months, and after that, the constant wetting causing the wood to soften and warp or swell out of form, the valve becomes useless. Street mains, specials and drips are, of course, in demand in the general order. Retort house tools, like all other tools needed in connection with gas works and gas works machine shops, are in great need, and the progress of establishing gas works here will be seriously retarded until supplies of the proper sorts of tools are sent here. Taps and dies, set-screw making devices, hammers, screw drivers, plyers, gauges, as well as all forms of tool house equipments and fittings, are wanted.

Hauling Coal to Gas Works in Philippines.

Coal and Coke Wagons.—There is not a proper coal or coke wagon on the islands, yet very large quantities of coke are handled, and serious losses are experienced by the proprietors of the coke works through lack of proper carts for transportation purposes. The principal form of cart employed is nothing more than a sled made of bamboo, which is drawn along by oxen or caribou, a view of one of these outfits being shown in one of the illustrations. Vehicles for transportation purposes are very scarce in the Philippines, and makers of coke and coal wagons should send some here where the prices obtained would be very good and the disposal thereof sure.

Systems of Street Lighting.—Burners of the patented sorts, lamps of various designs, iron poles, and devices for use in getting the proper illuminating outfit for street work, are of course wanted in conjunction with the other equipments for the gas works. The reason that iron poles are required is that the insects of the islands are constantly working away at the buried portions of any poles which may be set into the ground, and they so weaken the same in a short time that the pole breaks off under strain. The telegraph companies have a great amount of trouble with the wood poles which they are obliged to use, and are compelled to keep gangs of men on the road all the time repairing poles and putting in new ones where the ground pests of the islands have ruined the old ones.

Cast Iron Gas Pipe.—Wrought, steel and cast iron gas pipes, from 3 to 36 inches in diameter, are needed here in large quantities, both for the gas works' service and for water and oil conveying purposes. Malleable and cast iron fittings to go with the pipes are in constant demand, and the amount of patchwork done by the native workmen to overcome the lack of these articles is astonishing. I have seen workmen engaged for days shaping a piece of fitting for a pipe connection which the United States manufacturer forms in a few minutes on his machinery. Flange pipe for gas services, for sugar house work, mine work, water service, oil conveying, etc., is much needed, and high values would be secured for any furnished. Lamp posts are in demand.

Works are in progress here in which they manufacture lines of clay pipe, but this piping is not suitable for the services demanded of it. I have seen the clay piping tried in connection with natural gas which some of the soldiers discovered in the hills of Panay island, and this piping has gone out of service after a few months. The natives have a form of artificial pipe, made from bamboo, which they hollow out and wind with hemp and split bamboo until a solid piece of piping results, but which soon decays underground and becomes leaky.

Mechanical Charging and Drawing Machines.—Mechanical charging and drawing machines, gas enriching plants, recuperative furnaces, washers and conveying devices are needed. As to the conveyors, no one would run any risk in sending an outfit of these devices to the islands for the reason that the coal, metal and other miners would pay about any price for the proper assortment of rope, belt, or other forms of conveying and elevating devices. At the present time the operators of the lime mines, the cocoanut copra works, the sugar mills, tobacco plants, etc., are all obliged to depend upon crudely built, homemade devices for carrying products from one point to another in their works and the delays and trouble experienced are very great. Conveyors of recent patterns, and operated by power, either steam, water or wind, would serve all purposes and find ready sale here.

Dead Ladrone.

Engines, Water Wheels and Wind Mills.—Power is obtained in this country from four sources, the first of which is from steam, which is limited, owing to the few steam plants in the country; to water power, with any sort of old overshot and homemade wheels; to wind power, which is used with large wind mills, and to animal traction, the latter apparently being the most used of all. There is a good opening here for the sale of engines of from 6 to 100 horse power, for not only gas works purposes but for many others. Water wheels are also in demand, and the little turbines should be sent here to take the place of the awkward overshot wheels now in use. As to wind mills, these are made to do good service in this country, for as breezes are quite constantly blowing across the islands they can be depended upon. The animal traction includes the employment of caribou, oxen, horses, and, in some cases, man power. The devices are arranged in such a way that the turning beams can be pushed around or hauled by animals or by men. I have seen as many as thirty natives pushing around on one of these beams, devoting hour after hour to the work.

Gas Stoves.—With the opening of natural gas supplying wells in some of the islands there has been a call for gas stoves. When gas works are in operation it is very evident that the request for these stoves will be considerable, for the reason that the native housewives

are fast learning the ways of Americans in cooking, and they want American ranges, stoves, etc. As the continual heat of the day prohibits the keeping of a hot fire in operation, the use of gas stoves, the fire in which can be discontinued right after using, will be popular. Stoves finished in black or aluminum should be sent here, and the mechanism should be of the simplest sort, as the native women are not experienced in using anything more than a few stones for a fireplace.

Gas Tapping Machines.—Gas tapping machines for drilling and tapping pipe under pressure, without the escape of gas, and similar devices should not be forgotten in the furnishing of machinery and tools for Philippine gas works. Ammonia concentrators have already been called for, while hot water heaters, tar and carbonic acid extractors would sell at advanced prices. The demand for coal tar is very lively indeed among the shipping people, for they use it in large quantities on the sides of native sailing craft. The natives are always in the market for tars of all kinds, which they apply with a free hand to the interior and exterior of their bamboo shacks and "nipa" homes to keep out vermin.

Agencies Here.—Of course the best way to establish a gas works machinery business in the islands is to have headquarters in the three or four leading cities of the archipelago, from which points the smaller places can be supplied. The machinery supply stores of Manila and Iloilo would be only too glad to represent gas machinery concerns of America, and in fact the proprietors have informed me that they will represent the concerns of no other country, owing to the deception which has been practiced in former years upon them by Spanish and other concerns, which concerns would not fail to keep contracts and overcharge, but would also send here only out of-date, and often times worn out machinery which had been merely repainted and redated.

Mr. Dibdin's Latest Pronouncement on the Commercial Valuation of Coal Gas.

[From the *Journal of Gas Lighting.*]

The paper on the "Effect of Quality on the Consumption of Coal Gas," which was read by Mr. W. J. Dibdin before the London Section of the Society of Chemical Industry on the 3rd ult., appears in full in the current issue of the *Journal* published by the Society, together with the discussion thereon, and is therefore avoidable for further notice. There is no special novelty in it, and nothing in the way of an addition to the stock of knowledge on the combustion of gas. The fact that flat flame burners do not give economical results when consuming twice or three times the nominal rate, is known, not only to gas experts, but to a large section of the public besides. Under the plea of getting a uniform "unit" of light, Mr. Dibdin has simply been reproducing the ignorant practice of fifty years since, and burning gas under abnormally high pressures—a practice which was shown by the Gas Referees some thirty years ago to be prejudicial to gas of any quality, but especially so with low quality gases. To put the thing in another way, rich gases will stand a certain amount of latitude in the matter of pressure, while more care must be observed in the case of poor gases. But by the ingenious system of adjusting the burner to a fixed "unit" of light, irrespective of quality, consumption per hour, or pressure, Mr. Dibdin secures this important advantage—that the poorer the gas, the greater the pressure at which it is consumed, and therefore the greater the distance from circumstances which secure the best results.

The most prominent feature in the paper is the ingenuity exhibited, not only in finding a new setting for an old saw, but in constructing therefrom an *ex parte* case in support of the author's pronounced views on the subject of the valuation of gas. The law on this point is perfectly clear, as contemplating the establishment of special testing stations in central positions. But Mr. Dibdin holds very different opinions, as instanced by his introduction of the portable photometer. Bearing this in mind, the paper is an interesting example of the manner in which a professional expert can make the best possible use of facts that are in favor of his own side, and avoid or minimize those that are not. As an example of laboratory practice, it is without exception; and if it had been put forward and accepted as nothing more, there would have been but little to say.

But though listened to and discussed by a society of chemists, the paper was claimed to be a sort of general popular science guide for the instruction of the gas consumer; and although submitted to a body of scientists, there is no special scientific point in it. While the Society of Chemical Industry afforded a convenient platform for its annunciation, the members were only indirectly interested, in their capacity of gas consumers; and it might with the same propriety have been submitted to any average body of gas consumers, and would have been discussed with equal intelligence. For one might suppose that the members of the Society of Chemical Industry, by reason of their presumed knowledge of chemistry, would be more familiar with the elementary principles of economical gas consumption than the average consumer of gas, and more capable of applying those principles to their own advantage. But an interesting point incidentally brought out in the course of the discussion is that ignorance and prejudice as regards coal gas are not confined to the non-scientific section of the public. When subjects having a bearing on any point of science connected with gas engineering are brought before the Society of Chemical Industry, a full representation of gas engineering interests is never wanting; but gas engineers can scarcely be expected to discuss purely £. s. d. questions.

If Mr. Dibdin would bring forward, say, a new method of determining the proportion of carbonic oxide in gas, he would not have to complain of want of appreciation among the gas engineering fraternity. But when, on the strength of a few laboratory experiments made under impracticable conditions, and the results of which are not free from internecine disagreements, he asks them to discuss whether certain eventualities may or may not have the effect of compelling the consumer to use four times as much gas as at present suffices for his wants, Mr. Dibdin can scarcely be surprised if they are conspicuous by their absence, and prefer to discuss his conclusions in their own time and in their own way. He is not warranted in the deduction that such absence is a tacit admission that his case is unanswerable. As a laboratory investigation, his latest pronouncement is not the least important of his numerous labors in the cause of photometry, and affords some useful information which the gas consumer may apply to his own advantage. But if it is to be taken as a practical representation of conditions obtaining in the course of ordinary everyday use of gas or that might obtain if a small reduction in the standard should be allowed, then it possesses to the full those peculiar defects to which professional expert evidence is subject, and which tend to render it a matter of contempt in the eyes of the man in the street. The accuracy of the various experiments may be accepted, seeing that it would be difficult to find a more experienced photometrist or skilled experimentalist than Mr. Dibdin, as regards this particular subject. But one must challenge their utility as a means of ascertaining the value of coal gas, or of indicating to the average consumer the extent of service which he receives, or may receive, in return for the cash he hands to the gas collector every quarter.

The London gas-testing arrangements are of a very elaborate and costly character; and yet Mr. Dibdin himself condemns them as inadequate, if not useless. This suggests the question whether the photometrical game is worth the candle. How comes it that, in towns where the gas examiner receives no salary and apportions his labors in accordance with the remuneration (or rather the want of it), gas is as high in popular demand as in places where the gas companies directly, and the consumers indirectly, are mulcted in heavy charges for gas testing? Mr. Dibdin and his followers seem to take it for granted that the gas consumer has no weapon of defense besides the photometer; and that but for their valiant resistance he would soon be swallowed up by the unscrupulous gas monopolist. They overlook the fact that, in practice, gas is by no means such a strong monopoly as it is in a legal sense. Gas companies cannot compel any one use gas, but, like other tradesmen, are dependent upon the good will of their customers. It might almost be contended that the laws of supply and demand are a sufficient protection. Mr. Dibdin says that if the quality of the London gas was reduced 2 candles, the gas bills would go up to 70 per cent. or so, and that the consumer who now pays £4 per quarter would have to pay about £7. If such a thing did occur, the consumer would either largely curtail the use of gas or give it up altogether. The consumer knows about what value in the way of light or heat he receives, and how much hard cash he has to pay it. If the service is poor and the charges high, he will not be comforted or appeased by a satisfactory photometrical report; and if the supply is good and the charges reasonable, the steep upward curves on Mr. Dibdin's diagrams have no terrors for him, nor will he be in the slightest degree disturbed by the statement that his "equivalent" is in the neighborhood of 8s. or 9s. per 1,000 cubic feet. There are several gas companies in the United Kingdom whose standard is 12 candles; but in actual practice they supply something over 14 candles. As no English gas company supplies a less quantity than 14 candles, the experiments on gases below this

1. See Am. Gas Light Journal, Dec. 24, 1900, p. 1,004.

illuminating power may be at once ruled out of court as superfluous, if not worse.

One is reminded of the pieman referred to in a work of Dickens, who produced "veal and ham," "rabbit," or "pork" out of one common material, and explained that the "seasoning" made the difference. For Mr. Dibdin takes an honest 16-candle gas, and with "seasoning" composed of air, petroleum vapor, or the soluble properties of linseed oil, turns out to order anything between an 11 and a 19 candle gas. As 11 or 12 candle does not exist as a practical commodity, one cannot be very definite about it. But, really, a non-professional reader might form the impression that 14-candle gas as ordinarily supplied is simply a faked 16-candle article, touched up with a seasoning of air or other inexpensive diluent; and so it is necessary to explain that qualities of gas ranging from 14 to 19 candles, as supplied in practice, are manufactured as such in the first place, and not obtained by the simple process of adding air on the one hand or petroleum vapor on the other. A genuine 14 or 19-candle gas, as the case may be, would give results altogether different from Mr. Dibdin's "seasoned" gas; and, as evidenced by Dr. Percy Frankland's experiments (alluded to in the discussion), the "seasoning" will have a great effect on the results obtained.

It would be possible to select towns in which 14, 15, 16, 18 or 20 candle gas is supplied, and to arrange for a series of investigations to be conducted in each place; but this would involve more trouble and expense than could be reasonably expected from one individual author. Yet nothing less can be accepted as of the slightest use in connection with such a wide subject as the laying down of a practical guide to the average consumer as to what actually happens, or may happen, on his own premises. It is too much to ask that any particular quality of gas, low or high, should be condemned on the strength of laboratory experiments, made, for the most part, under impracticable and artificial conditions. There would not be much difficulty in reproducing practical conditions of pressure, etc., in the laboratory; and if the experiments are to be of real use as a guide, it is important that practical limitations should be observed. But a very large number of Mr. Dibdin's experiments could not be repeated on the consumer's premises. It is absolutely untrue that any gas consumer ever has, or under prevailing conditions ever will burn, as much as 12 cubic feet per hour through a No. 4 fishtail burner. Such a burner is constructed to pass 4 cubic feet at about 8-10ths pressure, and to get a consumption of 12 cubic feet, it would be necessary to have a pressure equal to 6 or 7 inches of water. The natural pressure of the gas supply on the average consumer's premises would be 15-10ths to 25-10ths—say 20-10ths—and he could not get more without resorting to special methods. The probability of his doing this need not be taken into account. Besides, the consumer will not have a noisy or a flickering light; and at a point somewhere below the maximum pressure in practice, the flame will begin to flicker and roar. So that Mr. Dibdin not only "fakes" the gas, but also the supply pressure.

Gentlemen interested in electric lighting occasionally find it very convenient to ignore the existence of the incandescent gas burner; and for similar reasons, Mr. Dibdin overlooks the existence of such a thing as a pressure regulator, either at the meter inlet or at the burners. Thanks to the labors of the London Gas Referees some thirty years since—labors that benefited the London gas consumer to a much greater extent than will result from the endeavors of Mr. Dibdin and his supporters in the direction of a 19-candle gas—it is much too late in the day to assume that the average consumer has not a fair acquaintance with the effects of excessive pressure and the unfortunate results it may exercise upon the bill. For more than a quarter of a century there has been a brisk trade doing in pressure regulators, and regulator burners such as those introduced by Sugg, Peebles and others. Mr. Dibdin secures another point by attempting to force a 12 candle to do the work of a 16-candle gas. The average consumer knows better, and would not think of trying to get a high "unit" out of a common fishtail or batswing, regardless of the quantity of gas consumed. In actual practice, if a company supplied at a pressure exceeding 3 inches, their district would immediately be invaded by an army of enterprising gentlemen, who would do a roaring trade in pressure regulators guaranteed to effect economy in the gas bill.

Mr. Dibdin assumes the existence of a gas consumer who wants his light in large parcels, uses none other than the flat flame burner without regulator, and demands that the quality of the supply shall be regulated to suit these conditions, regardless of financial or similar low class considerations.

If the appliances available for the use of the consumer were confined to the plain iron fishtail or batswing, and if the chief proportion of the gas supplied was of necessity consumed in such appliances, there would be some reason or method in his arguments. But, as a matter of fact, a very small proportion of the whole is used in this manner. Valued according to the quantity consumed, there are other appliances which could claim more consideration than the open or unregulated flat-flame burner.

To begin with, a large proportion of the total output is used in atmospheric burners as a source of heat, in cooking ranges, boiling burners, stoves, gas fires, gas engines and technical appliances. Something not far short of 50 per cent. of the whole is so disposed of. Then the incandescent lighting burner, in which the gas is really used as a source of heat, is not so small or insignificant an affair as Mr. Dibdin and his friends are inclined to suppose.

The sales reported by the Welsbach Company represent a very respectable proportion of the total number of gas burners in use, and average three or four per consumer throughout the country. Many gas companies who have taken up the agency, and who also undertake maintenance at a moderate rate, can report as much as six burners per consumer. Then there is the large quantity of gas which, though used in flat flames, passes through a pressure regulator of some form or another, and is thus prevented from being consumed at a rate greatly in excess of the normal capacity of the burner.

After making reasonable allowance for these various classes of consumers, it will be seen that the user of the unregulated flat flame is but a very small proportion of the whole, and certainly not of sufficient importance to be entitled to claim the right to set the time in regard to the quality of the gas supply. In considering the properties of a commodity like gas, which is used for so many different purposes, regard must be had to the requirements of the majority, and not to those of one class only, of which it may be said that it is becoming smaller by degrees and beautifully less. As changes in legislative enactments occupy some time in carrying through, when contemplating anything of this sort regard must be had not only to the present position but to the prospects of the future. If the crude flat flame community were likely to grow and increase, there would be some reason for urging their interests; but the reverse is the case. The public, and particularly that portion of it who believe in getting as much value as possible in return for their money, are beginning to recognize the fact that the incandescent gas burner affords by far the cheapest light extant, and is worth a little trouble in the matter of attending to mantles, etc. With mantles on the market at 6d. each, or less, a great extension may be expected; while large sales of cooking and heating stoves continue to prevail. Thus every year witnesses an increase in the demand for a heating gas, and a decrease in its use for lighting by unregulated flat flame burners.

[To be Concluded.]

India Rubber.

More than $100,000,000 worth of india rubber has been imported into the United States during the past 4 years, and more than $60,000,000 worth in the last 2 years. A decade ago the annual importations of india rubber amounted to about $15,000,000; now they exceed $30,000,000, and are steadily increasing. Practically all of the importations of rubber come in crude form for use of manufacturers, who are constantly extending its application to various new lines of industry. Northern Brazil, Southern Mexico, the West Indies, Central Africa, India, the Straits Settlements and the Dutch East Indies supply this increasingly important feature of our importations. Probably no single article has made a more rapid growth in its relations to manufactures, and consequently commerce, in the past few years than rubber. As a consequence attention is now being given to the cultivation and systematic production of the various plants and trees from which it can be produced.

India rubber is not, as is generally supposed, the product of a single tree, but on the contrary is produced from a variety of trees and plants. Some of these flourish only in a moist soil and atmosphere, while others thrive on stony soil, provided they receive ample though intermittent rainfall; though in all cases a tropical or subtropical climate is requisite. Most of the india rubber of South and Central America and India is from trees, but in the islands of the Indian archipelago, the supply of rubber is chiefly from a gigantic creeper, which in five years' growth attains a length of 200 feet and from 20 to 30 inches in circumference, and which yields annually from 50 to 60 pounds of caoutchouc. Java, Sumatra, Penang, Singapore and French Indo China are already large producers of crude india rubber,

or caoutchouc, and its production in the West Indies has been sufficient to indicate the entire practicability of its being made an important industry in Cuba and Porto Rico, as well as in the Hawaiian, Philippine and Samoan Islands.

[Concluded from Page 211.]

The Coming Exhaustion of Nature's Stores.[1]

Passing from metals to minerals, it is a fortunate fact that the world's stock of the most useful and durable of minerals—building stone, clay and cement making material—is inexhaustible. This fact, we may be sure, will have a large influence upon the work of the engineer of the future. It is not difficult to foresee a time when, with timber practically exhausted and metals grown too scarce and expensive for structural use, a return will be made to the stone structures which were so prominent a feature of an earlier period of history.

Even now, at the beginning of the new century, we see concrete and stone taking the place of steel, and there can be little doubt that this substitution will continue in much larger measure in coming years. In fact, one can easily foresee the time when men will wonder at the fatuity with which in the 19th century engineers built structures of thin and rapidly wasting steel, protected only by a quickly perishable wash of paint and called them permanent.

Perhaps such forecasts of the future as this may seem fanciful and far fetched to some of our readers. If so we can only advise careful and unprejudiced study upon these topics. The engineer ought to work for the future as well as the present, and to do so intelligently he ought to form an intelligent opinion as to what the future will bring.

Of all the accumulated stores of Nature on which the world is making rapid inroads, that which is destined earliest to disappear is doubtless the timber supply. The need for husbanding this has long been urged, yet each year the lumberman's axe and the forest fire make huge reductions in the area of forest still standing. Higher prices for all classes of timber and timber products are a certainty of the near future; and such prices, while they will scarcely diminish the consumption, will s imulate the lumberman to penetrate still more remote regions of forest. For the three hundred years since the settlement of America began, the work of removing the primeval forest has been in progress to supply the demands not only of America, but of Europe; and now the last and noblest of these forests, that on the Pacific coast, with its giants whose age is measured not in years, but in centuries, is rapidly being converted into timber and boards and shingles.

Mr. Henry Gannett, of the United States Geological Survey, as a result of careful studies of the timber resources of the United States, estimates that at the present rate of consumption, the available stock of timber on this continent will be exhausted in approximately a half-century.

When one considers the multitudinous uses to which timber is put, the outlook is serious enough. We can with advantage substitute some less perishable material in many places where timber is now used; but there are other places where it will be well nigh impossible to find a satisfactory substitute. For example, what can the miner do without timber? How can mines be worked at all without timbers to support shafts and galleries and tunnels? Economy can, indeed, be practised here as in many others fields where timber is now wastefully used; but more or less timber appears to be absolutely necessary here, and indeed in nearly all classes of engineering work.

Fortunately, the world's timber supply is not like its store of minerals—absolutely irreplaceable when once used up. The forest can again be made to cover areas which have been denuded of trees and yet are not suitable for agriculture. By taking proper measures in season, new sources of timber supply may be made ready against the day when the old ones are used up.

It may be said, perhaps, that measures which look so far to the future are impracticable, under our present social organization. But is it not true that the extent to which provision is made for the future is a fair index of the progress of civilization? The barbarian literally took no thought for the morrow. He lived in alternations of plenty and starvation. The pastoral stage of civilization, with its flocks and herds, and the agricultural, with its reliance upon the soil for annual crops, followed in succession, each one marked by its greater provision for future needs. Finally, we have our present day modern life in which men strive to provide not only for the necessities of changing seasons, but for the time of old age and incompetence, and even for the later wants of children and children's children.

1. *Engineering News.*

In the last analysis, legally as well as morally, public necessity has always a higher claim than any right of private property. It is entirely within the abilities of civilized governments to provide for such manifest necessities of the future as the conservation and perpetuation of the timber supply, the econonical use and prevention of waste of the earth stores of petroleum, phosphorus, coal and any other products in which present consumption threatens to bring the world to an early famine. No rights of private ownership to use or waste at will are paramount to the public necessity.

It may be said that these are problems for the statesman rather than the engineer; but it is to the engineer and the scientist that the statesman will look for guidance upon these great questions. It is the engineers in the service of corporations whose future existence depends upon the supply of raw materials which the earth furnishes, who are most conversant with the diminishing supply and increasing demand and who can first foresee its results.

It will be apparent that in the above brief review we have only touched upon a few most important phases of a great world problem. We have ventured no forecast at all, for example, of the conditions which will confront the race when the stored mineral riches of the earth are finally exhausted, and mankind is compelled to compass its wants by what the annual product of the soil will furnish. So many new and now unthought of factors will then exist that the wisest can make no useful prophecy of human environment at that day.

In the review above we have confined our forecast only to the present century, a period of time no greater than the span of a human lifetime. This, surely, is not too far in the future for our present day civilization to make provision. In commerce, in finance, in the field of statesmanship, it is not uncommon to look ahead as far as this.

The engineer, who has in the past utilized Nature's gifts for man's service, and whose pride it is to build for the future as well as the present, ought to foresee coming scarcity of these gifts, for it is to him that the world will look for a warning of scarcity and for guidance as to how future wants may be supplied.

Electrical Illumination at the Beginning of the Twentieth Century.

[Abstract of a lecture by Dr. Louis Bell, before the New York Electrical Society.]

In his opening remarks Dr. Bell said he would not speak of the science of electric lighting, but rather of the art of electric illumination. The art has been as much neglected, perhaps, as the science has been cultivated. He did not propose to waste any time in explaining the doctrine of the electric current, which he would take for granted, and take the appliances which we have for granted, and try to briefly explain what we can do with them in the way of getting illumination, which is, after all, the object for which the whole science of electric lighting has been developed.

To begin with, there is generally a good deal of misconception as to what we want by artificial illumination. There are two radically different doctrines, one may say, although they have not been formulated as doctrines, with regard to electric lighting and to artificial illumination of all sorts. One is that when we do artificial lighting we must try to vie with Nature herself, beat Old Sol at his own game. The other recognizes some of the limitations which finite intelligence and finite resources have imposed upon us, and goes at the subject of illumination, not as rivalling the illuminants of Nature, but merely as furnishing such amount of light as we actually need for some useful purpose. Our grandfathers, or great grandfathers, as it may be, did all their reading by the light of the tallow dip, save and excepting such of them as rose to great fame and did their reading by the light of pine knots, which was considered a sign of great genius for many centuries. These two views of electrical illumination have come from, on the one hand, a lack of comprehension of illuminants, and on the other hand, from a realization of what the actual conditions are when we attempt to furnish artificial light.

To begin with, at the present time it is safe to say that more illumination fails from being too bright than from not being bright enough. By too bright is meant too intense, as will be presently shown. The eye is a very curious optical instrument. Helmholtz used to say it was one of the worst optical instruments with which he was acquainted; that if an instrument maker had sent him such an instrument so badly constructed with reference to all scientific principles as the human eye, he would send it back, with thanks. Nevertheless, it has one peculiarity, one power, which is the basis of all our

attempts at artificial illumination, which makes it possible, practically, to get artificial illumination, and that is the human eye can work over a tremendous range of brightness and still do its work effectively. We can read in brilliant sunlight, or by the light of a single candle, with fair comfort in both cases, although the candle is nearer than the sunlight. It makes comparatively little difference whether we read by the light of one of these arc lights or a single candle, so far as comfort goes. For other purposes the arc light is very valuable, but the eye itself gets along very comfortably, even when the amount of light is considerably reduced. That comes from the expansibility of the iris of the eye, widening or narrowing the pupil, in accordance with the demands of the occasion. Cats, bats, owls and all nocturnal animals have a tremendously expansive pupil, as you know; the cat's ranging from a mere infinite narrow slit to a full and wide pupil, as night comes on. An eye contracts ten or a dozen times less than its maximum dimension when a brilliant light comes on. As the light increases the pupil contracts; as the light decreases the pupil expands, letting in more light, and so enabling us to work satisfactorily with all sorts of artificial light.

Think, for a moment, what would happen if we had to have the equivalent of daylight to do our work, or have our pleasure, in the evening. It would be substantially impossible to furnish the equivalent of daylight, except with an enormous number of arc lights. Fortunately, the eye is so constituted that, provided we work within a fair range of illumination, we get along very well; and that, moreover, enables us to produce some of the most useful effects which we get from artificial illumination.

Whatever the source of illumination, there are some fundamental principles we must not forget in trying to do artificial lighting. The first is that the source of lighting ought to be unobtrusive, and, if you stop to think of it, that is the direction in which most artificial lighting errs. Instead of the source being unobtrusive, it is obtrusive, even unpleasantly so, and instead of helping the vision, often hinders it, for the reason that a bright point of light in the field of vision causes the pupil to shut up and protect itself and lessens the amount of light entering the eye, so that one cannot see with anything like the convenience which the amount of light would indicate. Excessive brightness of a particular spot is a thing to be avoided in all illumination. This is the reason for globes inclosing the lamps. The eye sets itself as regards the width of the pupil, as regards the effective aperture through which light falls on the retina, approximately to suit the brightest point in the field of vision, and as a result of that a very bright light dazzles the eye, and makes it extremely difficult to see objects which are not given bright illumination and causes trouble. Any one driving along a street or road, particularly in the suburbs, particularly where there have been shadows, on a road illuminated by electric lights, realizes how difficult it is to see beyond them. At the time we had the towers, with large lights, at Hell Gate and along the entrance to the Sound, there was constant complaint from the pilots of various boats that the lights bothered them. At that time the persons who put the lights there turned up their noses and said, "That cannot be; we are giving you fine illumination." So they were, but they were giving it from radiants so bright that the eyesight of the pilot was somewhat dazzled, the pupil contracted, and light coming from objects beyond and around, not equalling in brilliant illumination the lights in question, did not make sufficient impression upon the eye; in other words, you cannot see across a brilliant light.

A very little experience with the arc light convinces us that, although it is a magnificent light, the light is unsatisfactory because it gives too much light in one place. The increase in brilliancy in arcs of that character is enormously great. It amounts to, say, 30,000 to 50,000-candle power per square inch of radiant surface, and that is a brightness of which it is really hard to form any conception. Imagine, if you can, 10,000 candles concentrated in the flame of a single candle, and you get some idea of the intrinsic brilliancy, the dazzling rays, that proceed from an unshielded arc light. Anything of that kind is simply bad illumination. It may be an extremely good light, but for illuminating purposes it is unsatisfactory, except in certain rare cases where, as in some of the early arc light experiments, the lights were put so high they would be out of the field of vision. Under these circumstances, when the rays would not fall directly on the eye, one could get along comfortably with the bright lights. On the other hand, the lights were put so high that the actual illumination from them was much reduced, so that one may say that the unshielded arc light has no place whatever as a general illuminant. There are cases where it is very valuable, but for general purposes it has been, as you see in this city, superseded by arc lights inclosed, not in one globe only, but two, with the inner globe immediately surrounding the carbon.

The intrinsic brilliancy of the arc light is the highest artificial brilliancy with which we have to deal. We have all the way from 20,000 or 30,000 to 50,000 candle power per square inch in some portions of a very bright arc. Some estimates have run as high as 100,000 candle power per square inch of radiant surface. The calcium lights, with which we were familiar as bright illuminants, have only 5,000 candle power to the square inch, while the ordinary incandescent light has only a matter of about 200-candle power to the square inch. And even that is too bright. If you will look at it intently for a moment, you will see, when it is out, that you will catch an after image in the eye of that bright filament. The after-image is a symptom of what may be serious effects on the eye if long continued. As a result, one can safely say that even the ordinary incandescent lamp, valuable as it is as an illuminant, is intrinsically too bright to yield entirely satisfactory results. That is the reason why people used to say so often—they are getting over it now—that the electric light was hard. What they meant by that was that it was too intense in its brilliancy; although giving an abundance of light, the brilliancy was too intense to give thoroughly satisfactory results as an illuminant. Better results are obtained from a smaller lamp of 8 candle power against 16 candle power in another, and provided with a ground globe. The result is that the brightest spot on which the eye has to dwell is very much less bright than the naked filament of the incandescent lamp. This brilliancy has fallen off, from being 200 to 250 candle power to the square inch, to being, perhaps, a matter of 15 or 20 candle power to the square inch. That means that the eye adjusts itself with reference to the brightness of the entire lamp, the central portion being the brighter, and the pupil does not close as far, and one can see almost as readily with one lamp as with the other. In fact, the smaller lamp with ground globe is preferable, for the reason that the brilliancy being less, the pupil of the eye is wider, the effective aperture for the light used much greater, and the ability to read much greater, than it is with the very brilliant light, such as is given by the other lamps. In view of the automatic adjustment of the eye for the maximum brilliancy with which it has to contend, it does not matter much how it is done, so that the light is diffused, and lamps of that kind give a much more satisfactory illumination than lamps with naked filaments, in spite of the fact that the grinding of the globe cuts off from 25 to 30 per cent. of the total light, but the 70 to 75 per cent. left is enormously more useful than the original 100 per cent., because the intrinsic brilliancy is lower, so that the eye adapts itself to the more favorable condition.

Another fundamental point in illumination, which is sometimes forgotten, and which is really important, is its direction. One would suppose at first that it would not make any particular difference what way light fell upon an object which is to be illuminated; whether you got it horizontally from the side, whether you got it from below or from above, yet, in point of fact, it has been found by long experience that light from above is much more useful than light from the side, or, particularly, from below. This is probably due to the fact that the eye, through the many centuries of its development in man, has gotten habituated to geeting sunlight from above, rather than light from below. It is a well established fact that light which comes from an abnormal direction into the eye is sure to produce fatigue in one way or another. For example, light reflected from snow is peculiarly severe and often produces a species of inflammation resulting in snow blindness. Not because of its great brilliancy, for it really is not any brighter than the sunlight, nor nearly as bright, but because it comes upward from the snow, entering the eye from an unfamiliar direction, and probably concentrating its strength on that part of the retina less able to bear that particular sort of pounding from a brilliant light. It has been found that blacking the lower eyelid with burnt cork will stop the development of the snow blindness. You cut out the ground light which comes from below and remove the principal cause of the irritation. So there are two things to be specially considered; first, the maximum brilliancy of the illuminant should not be very great; it should be rather moderate; it should not be obtruded on the eye, and the direction should generally be downward and not upward.

The foregoing leads to the value of diffused lighting. Anything like diffusion of light means there will not be any one particular point which is very brilliant. The brilliancy will be rather moderate. At the same time an enormous amount of light can be successfully diffused in practice, and on diffusion we depend for some of our most valuable results in illumination. You can easily get an idea of the amount of the diffused light in any room by a simple experiment; that is, by turning out the lights which are available, and then shield-

ing yourself from the only source of light which you have left, when you will find, in spite of being in the shadow, considerable light will still be manifest all about you. A room with white walls will give 2 or 3 times the effective illumination, with the same radiant, as a room which is painted in dark colors. A white painted surface is the very best diffuser of light. A white surface will diffuse from 60 to 80 per cent. of the light which falls upon it. The light shades of yellow, almost as much. The distinctly yellow shades are also admirable for diffusing light. Then come the shades of red and orange of various kinds. Then come the light blues, and, last of all, the very deep blues and the greens. A dark green is perhaps the worst diffusing surface that can possibly be found. A room light in color can be successfully lighted by diffusion alone, where there is no direct radiation falling upon the eye at all. So netimes it is a very excellent scheme to avoid too brilliant radiance, also to get a correct direction for the illumination, by depending entirely upon diffusion. Diffused light is apparently not as efficient as the brilliant light you get from an unshaded arc. It takes, undoubtedly, a great deal more of energy to give an equal amount of light in candle power; at the same time it is a question whether lights supplied in that way consume the same amount of energy as a single arc light would to give the same illumination in the room. It is safe to say that the diffused light will give a much better illumination in spite of its lessened gross amount, on account of the fact that the light comes from the direction which is most useful, and is faintly toned to a pleasant color by the slight tingeing of the ceiling.

Color is a matter of great importance to illumination, for two reasons and in two particular ways. In the first place, the color of the light which we are wont to receive is not white; it averages a rather yellowish white. We sometimes think it necessary to obtain extreme whiteness of illumination. An illumination of normal color, that is to say, a somewhat yellowish white, is the one to which we are all used, and by which we are wonted to judge the colors of objects about us. If one were judging colors, exclusively, the particular kind of light you would want would be daylight, or as close an approximation of it as could be obtained, so that we find in order to get a correct judgment of color it is sometimes necessary to have a clear white light, and that color we have to get practically by arc lamps. Deep colors are always unpleasant and entirely unsuited to any practical illumination. In general, it is safe to say you cannot trifle with the color of your illuminant without producing disagreeable results; it makes no difference what the exact shades are. It is very desirable to confine one's self in the use of colors in illuminants to colors to which one has become habituated—that is, white or yellowish light. A light derived from shaded arcs placed above us is not as pleasant as the cornice light I have just shown. Certain colors of light are associated with certain things in the theater. They always attempt to get moonlight by a curious shade of bluish green, and it may be interesting to note that moonlight is greenish. That arises from the fact that moonlight, measured in candle power, or in any terms by which we usually measure illumination, is a very weak light, and the eye loses its sensitiveness to red and blue before it loses its sensitiveness to green. As the light fades out toward the sunset, just as daylight is merging into darkness, one's judgment of color gets warped and twisted by the faintness of the light. Reds and blues lose their brilliancy, and so when the moonlight comes on, there is actually left a preponderance of greenish rays, which are mimicked on the stage by putting the proper shade of green before the projector.

Practically all our sources of light at the present are incandescent solids of one sort or another. The flame is merely the aggregation of white hot, yellow hot or red hot particles of carbon. The incandescent filament is merely a filament of carbon heated red hot, or white hot, as the case may be, by the current. In the case of the arc lamp we have the same thing, the radiant point there being the crater of the arc at ends of the carbon, which are heated to a very high temperature indeed, and are brilliantly radiant. It should be borne in mind that the temperature of the flame, or the temperature of the radiant matter, is the thing which largely determines its color. A piece of iron heated moderately is red hot. After a bit it gets nearly white hot, and yellow hot, and finally it comes to a dazzling brightness, or whiteness. The same is true of any incandescent solid. We find certain oil lamps give a distinctly orange tinge; we find candles giving a pronounced yellowish tinge, with much red, and the gas lamps give a yellowish hue, with less red. Finally, the incandescent lamps, when they are thoroughly energized by the current and heated extremely hot, give a light which is almost pure white—as white as the arc; and the arc lamp, which has a higher temperature than all the others, gives a light which is distinctly white or bluish white.

It should be borne in mind that in incandescent lamps the question of color has not anything to do with the amount of light; simply the temperature of the filament which gives the light. For instance, take five incandescent lamps of precisely the same candle-power (16), all working on the same circuit, with the same voltage; yet of the one having its filament of a higher temperature if near the others on a fixture nine persons out of ten would say that is the brighter lamp, whereas it may not be as bright as the others. The color in the lamp is simply a matter of the temperature which it carries, and with a given number of inches of filament in a lamp at the same temperature you will get the same total light in every case. It may be distributed in one way or another, but the candle-power of the lamp really means so many inches of filament at such a temperature, the filament being of a specified size. The ordinary lamp, as used in practice, gives a bright, clear, slightly yellowish light, but, on the whole, it is a very satisfactory color for general purposes.

For the purpose of obviating the extreme brilliancy which we get from the unshielded light, the best general expedient is the frosted globe. There are many others which can be used successfully. The ordinary lamps which we have in commerce are either 16-cp lamps or 8 cp lamps. For example, if we place a 16-cp lamp of the frosted type, which gives a very excellent, soft, clear light, alongside a 16-cp naked filament lamp, the frosted light seems to give, and for practical purposes does give, by far the better light. The basis of all practical electric illumination is this country for interiors is the 16-cp lamp. It should always be used in a frosted form, or otherwise shaded, except in instances where indirect illumination is attempted, when it can be used with the naked filament successfully. The 8-cp lamp should be the favorite. Lamps of 32, 50, 100 and 150 candle-power are freaks. They are used for some occasions, but not lamps to be considered standard or convenient for the ordinary purposes of interior lighting. A 4-cp bare filament lamp makes a pretty light where a small amount is needed. The filaments in this lamp are delicate; indeed, so fine you cannot see them except in a good light, and the lamps have not the endurance of the 8, 16 and 32-cp lamps which are mostly used.

There are various ways of lessening the extreme brilliancy of incandescent lamps besides the use of the frosted globe. For example, we have lamps which can be toned down very materially by the use of shades, which produce, in not a very striking way, the same softening of the light which you get from the use of the frosted bulb. Various sorts and kinds of shades have been tried. These shades produce the same effect in toning down the apparent brilliancy that the frosted surface produces, and they, moreover, cut off less light than the frosted globe, and throw it conspicuously down or out sideways, as the case may require. This particular form is what is known as the holophane globe. There is a wide range in these globes. One is a diffusing globe, which throws the light out in a very satisfactory way, and produces precisely the same effect, as far as the eye is concerned, as the softening which you get from a ground or frosted globe; and, in point of fact, the loss of light in holophane globes, which are accurately cut, is only about 10 or 12 per cent., whereas in the ordinary ground globe it is a matter of 25 or 30 per cent.

The incandescent lamp, in spite of its usefulness in a general way, is, from a scientific point of view, unsatisfactory. You cannot get a high enough temperature in the filament to give the efficiency you want to get. Of the total energy which goes into a lamp, even if a 2-watt lamp, only about 5 or 6 per cent. is returned to you as light. The rest of it goes into heat. The amount of heat radiated, in spite of the fact that the incandescent lamp is of all the ordinary illuminants the one that gives the least heat, amounts to 94 per cent. or thereabouts of the total energy supplied to the lamp. The low efficiency is due purely to the fact that we cannot carry the filament at a temperature high enough to get the desired increase in efficiency. For the purpose of improving the efficiency there have been conducted experiments innumerable, but the best products of to day are lamps running at 3 watts per candle or a little under, but still they have an efficiency of only between 5 and 6 per cent.

For better results than that we have to turn to other sources of illumination, and the obvious thing to do is to carry up the temperature of the illuminant to a point far beyond that which is found in the incandescent lamp. This is done in the arc lamp. At the temperature of the arc the carbon is vaporized very rapidly. Carbon, such as you find in the arc lamp, and in the filaments of incandescent lamps, is a substance somewhat volatile. It volatilizes somewhat like iodine, passing from solid into the form of vapor and softens and gets putty-like, so when incandescent lamps are carried to a high temperature the filament softens and rapidly breaks. As a result we have to look to the arc for

help. There are small arcs made for the purpose of getting from lamps of moderate power an efficiency which we cannot get from even the best incandescents. Such lamps, in mere candle-power, may only be equal, in actual illuminating power, to these incandescents, but they seem brighter. The intrinsic brilliancy is greater, and the lamp itself appears to be a very bright object. It is very white, and it is very bright, as regards its intrinsic brilliancy, but the absolute amount of light is probably less than from the incandescents. Yet one of these lamps takes only the energy which would be taken by three 16-cp incandescents. The arc is a different kind of a flame. It is much more powerful as an illuminant, and is enormously brighter, owing to the fact that its efficiency, while perhaps not doubled, is probably as high as 9 or 10 per cent., as against 5 or 6 per cent. on the incandescents. Lights of this kind could probably be shaded if they are going to be put where they would fall within the range of the eye. If you do not shade them, you will find the same trouble as with the incandescent lamp with naked filament.

Small arc lamps of this kind give more efficiency than the incandescent lamps, and for some purposes they may be quite useful. They are intensely white, giving a light by which it is possible to judge colors with great accuracy, and are highly efficient; but, of course, they are open to the objection to which all arcs of too great brilliancy are open. The brilliancy of the arc can be cut down in various ways, the most obvious one being by the use of globes. An arc light which would be intolerably bright, and entirely unsuited to practical illumination when unshielded, becomes, when hidden behind globes, a very satisfactory source of light, providing it is not thrust down where you have to look directly at it.

There is a difference, even in arcs, in point of brilliancy, and there again, just as in the incandescent lamp, it resolves itself into a question of temperature. The bigger the arc is, the larger the volume of current and the hotter the arc gets, the more efficient it becomes. Some of the earlier lamps, which carried a heavy current and gave a short arc, were tremendously brilliant and very efficient. A lamp with a short, flat arc, taking a heavy current, is enormously efficient. It has perh ps 25 per cent. more efficiency in producing light than small arcs, because the carbon is carried to a much higher temperature. It is, however, an arc which is not now a favorite, by reason of its unsteadiness and hissing and spluttering. We have passed now almost entirely to the inclosed arcs.

The inclosed arc is simply an arc with an airtight globe around the carbon, the airtight globe having a sleeve at the top into which the carbon fits nicely, so that the air has the oxygen burned out of it, the carbon burning in an atmosphere which does not oxidize rapidly and consequently gives a better light. The inclosed arcs generally have around them a second globe. If the second globe is a holophane globe, there will result an admirable distribution of light, which is softened in a way highly satisfactory, without, at the same time, cutting off any considerable amount of light. The absorption of the globe is probably not over 10 per cent., while the light still looks bright, but is not by any means as dazzling as it would be without a globe, or with a very light ground globe. These inclosed lamps are somewhat subject to different classes of color. The earlier ones gave a very perceptible bluish white light, a light not altogether satisfactory for general purposes, but, on the whole, a very useful one. As time has gone on, the inclosed arc has become more and more effective, so the light as we have it there is entirely satisfactory in color.

The alternating arc is another example of the way in which the temperature of the heated body affects its efficiency. The first type of alternating arc brought out was the Jablochkoff candle, which was used years ago for illumination in Paris. The light it gives off is curious in color, because between the two carbon elements conveying the current there is a thin strip of kaolin which becomes very hot, and the kaolin gives out, like the lime light, a considerable amount of light of its own In fact, the principle of the Jablochkoff candle, with its bridge of kaolin between the light and the carbon, is quite similar to the principle of the Nernst lamp which has recently been brought out. In that case there is conduction across a stick of substance which is normally a non-conductor. In this case there is a kaolin strip which passes between the two carbons. The lamp had, from the earliest times, the unpleasant habit of going out on small provocation, and as the lamps were practically used, they had several carbons with a very ingenious way of shifting the current from one to the othar, in case one came to grief. The carbon, if you can call it a carbon, consists really of two conducting strips of metal rather than a carbon, properly so called, and between them a stick of kaolin composition. These edges are barely more than copper plated on the surface, so that while the conductors are really along the edges of the carbon, the white central strip is the thing which gives the majority of the light. They originally started off by using strips of carbon, but the particular sample shown to the audience is a metal conductor running down each edge of the light-giving element, and between the two is a mass of kaolin which becomes a conductor and gives a very brilliant light after it is once started. The principle of using the kaolin, which is itself a non conductor except at high temperature, as the light giving element, is, as stated, similar to that in the Nernst lamp, of which we have heard much in the past few months, and probably will hear more. Next we have an example of the alternating inclosed arc, which has the same general appearance of comparative steadiness and long burning of the carbons that the continuous current inclosed arcs have, but at the same time it is, for obvious reasons, principally lack of sufficiently high temperature, somewhat less efficient. The lights are very serviceable, however, where the direct current is, for one reason or another, not available.

After all, you will say that the efficiency of even our best illuminants is not very high. The efficiency is not anything like what we would have it. It is not a very comforting thing to think of putting in 100-horse power of energy and getting out 5 horse power in this form, the form in which you want to use it. It is not consoling to think of utilizing any arc lamp, and getting out, if you have good luck and use a first-rate lamp, 10 per cent. of the energy you put in. The efforts of many inventors have been bent in many directions trying to get an arc lamp or incandescent or some kind of a lamp which would return a reasonable amount of the energy put in, but so far none of these experiments have led to anything commercial. The Nernst lamp is extremely interesting as an attempt in this direction. The weak point of the carbon, as I have already stated, particularly in the form of an incandescent filament, is the fact that it will not stand high temperature. It vaporizes, smokes up the inside of the globe, and generally goes to pieces. The Nernst lamp utilizes a little pencil, hardly bigger around than the lead of a pencil, perhaps 1 inch or 1½ inches long, of some refractory material, like magnesia; in point of fact, the material used is much like the material used in the mantles of the Welsbach gas burner, but this material possesses the property of being a conductor at high temperature. At ordinary temperatures, it lets through no current, but at high temperature it becomes quite as good a conductor as carbon.

The principle involved is the same as in the Jablochkoff candle. That is, the formation of an electric arc, heating to an enormous degree a pencil, in that case a little thin slip of highly refractory material, which becomes conducting and goes to an enormous temperature, and gives out a great deal of light. By the use of that refractory material, and handling it as deftly as may be, a fair efficiency is obtained, an efficiency, however, which is not greater than we have in the arc light, probably (indicating); that is to say, the highest claimed is about 1½ watts per candle, but the chances are that the filament of more refractory material would outlast the lamp, and in that fact lies its chance for success.

There is a determined effort going on to better the efficiency of the incandescent lamp, but the result is not by any means certain. It is certain, however, that a lamp has been produced which does give an efficiency as high, or higher than can be obtained by any incandescent lamp, and approximating that which can be obtained by the smaller light of the electric arc, and that is one very encouraging direction for experiment. I imagine that in six months or a year the Nernst lamp will become, perhaps not a common sight, but a lamp which will be found more readily than one could be found for the purposes of this lecture.

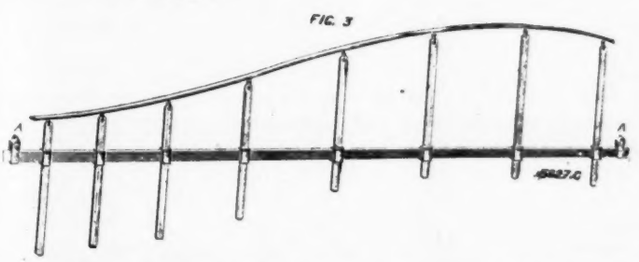
An interesting line of operation is that which depends on the dropping of incandescent solids and passing to incandescent gas. The phenomenon on which experiments of this kind are based is that of the passage of electricity through rarefied gas, such as seen in the ordinary Geissler tubes. There is every reason to believe it is possible to extract from incandescent gas perhaps as high as 25 or 30 per cent. put in it, in the form of light. Nevertheless, the difficulties in the way are many. We have available very good incandescent lamps, very good arc lamps, and we have an enthusiastic hope of getting something along the line of the Nernst filament which may be useful. We have an earnest wish that we may perhaps discover in the use of incandescent gas a higher efficiency than we can get from solid incandescence, and we have an illusory sort of an idea that, if fortune favors, we may discover the secret of the glow worm, but of that the glow worm himself will have to speak. Science does not know his mind in that regard. So we can say, in summing up the progress, at present we have a very useful means of illumination, but we have not, by any means yet reached the point where we can look pleasantly on our artificial illumination and say we have anywhere nearly what we want.

Incandescent Gas Mantles Made from Lime.

According to Herr H. Helmcke, of Hamburg, serviceable mantles, particularly well adapted for high pressure gas, can be made from lime. To a soluble salt of lime is added a small percentage (3 to 5) of alum or of borax, which does not act, so to speak, as a component of a mixture, but as an impurity which has the property of altering the physical properties of the substance in which it is present. A mantle made with such a solution splinters comparatively little, is tough, resists heat, and in a water gas flame it gives a good light. The lime does not fuse with the borax or alum, but is toughened by it. There are some advantages in using lime water instead of a solution of soluble lime salts, even though the amount of lime which can dissolve in water is so small. The mantle made with lime water is very easy to burn off, while with salts it is more or less difficult to get them reduced to oxide. Nitrate alone is not good, for the mantle crumbles; acetate needs burning off with a strong flame; and so does chloride of calcium. Mixtures of salts of lime do better. The following is found to answer: 1½ parts of potash alum in 100 of distilled water at 140° F.; when cool, dissolve 30 parts of CaO to form a milky liquid, which is to be well shaken and the fabric (well cleaned) kneaded in it. Again, 15 to 25 parts calcium nitrate and 20 to 10 parts acetate or chloride in 100 parts distilled water; filter and add 1½ parts potash alum dissolved in the least quantity of distilled water at 140° F. Burning off has to be continued until the grey becomes white. Mantles so made are cheap and work better than the present ones with extremely hot flames.

Adjustable Curves for Draughtsmen.

Mr. William J. Brooks, No. 5 Compton street, London, England, is the designer and manufacturer of the three different types of flexible curves shown in the accompanying illustrations. It is true that the



designs are intended primarily for use in connection with shipbuilding operations, but the adaptability of the scheme is such that draughtsmen will find good use for it in the outlining rooms of other types of engineering works. The curve shown in Fig. 1 is made entirely of celluloid, and is provided, it will be seen, with five finger rests. By placing the fingers and thumb of the left hand on these the flexible strip can be adjusted to fit any curve, which can then be drawn in with the right hand. In Fig. 2 another arrangement is illustrated. In this, the flexible strip is a piece of spring steel, having the linkwork shown attached to one side of it. This linkwork is provided with stiff joints, so that once the curve is bent into any shape it retains it until intentionally altered. It is thus possible to draw a symmetric figure by setting the curve correctly for the drawing of one side of the figure, and then turning it over when the other side may be drawn. This form of flexible curve is found useful in railway work for setting out yard switches and the like in the drawing office. In Fig. 3 is shown a third form of curve, intended specially for shipwork. In this case the flexible strip is of wood, and is adjusted to shape by moving the cross pieces shown up or down. These slide in brass sockets, and remain in any position in which they may be placed. The knife edges *A*, *A* are intended for adjusting the curve to a center line, and it will be seen that the front portion of the spline can, if desired, intersect this line, which is necessary with the forms of ship body now frequently used. Having adjusted the curve to the proper form and drawn one side of a ship plan the other can be drawn in by reversing the curve. This pattern is also made with a flexible steel strip, instead of the wooden spline. Each pattern is made in several sizes.

Foundry Iron.

[Read by Captain Henning, Imperial Artillery, Berlin, Germany, before the American Foundrymen's Association.]

One of the commonest arguments against chemistry in the foundry is the well known fact that irons with the identical composition may show widely different physical properties, and, similarly, good castings of a given kind may vary considerably in their composition. The importance of this situation makes it imperative to trace the causes for the apparent contradiction.

In every case of this kind which has come to my notice, whenever the pig iron showed the proper analysis the blame has been placed upon the foundry. Poor molding, cold iron, unequal cooling, abrupt change of section, trouble in the place from which the test pieces were cut or difficulties in making a separate set of test bars, are considered as the primary causes of failure to see predictions carried out. It is also known that the cupola itself has a great influence on results, for with the same mode of operations and material one day's run may be quite different from the other.

My own experience in one foundry has shown me that different shipments of one brand of iron, in spite of a practically identical composition, may produce quite different results and that the foundry will not be to blame therefore. This particular foundry was accustomed to work so painfully exact that the conclusion was forced upon all of those interested that the root of the evil was to be looked for in the blast furnace. It is a well understood fact that even with the most uniform burden a blast furnace cannot make absolutely uniform pigs so far as their composition is concerned, yet the end product will be comparatively more homogeneous than a cupola process could make it, for the quantities are much larger and the process is a continuous one. If, now, the greatest care is taken in running the cupola and handling the molten metal the unavoidable differences in composition in the castings made will be found to be quite unimportant if only the same care is taken with the burden in the blast furnace.

With a pig iron thus carefully made I have had no trouble whatever in producing a perfectly satisfactory run of castings where the composition ranged from 3.50 to 3 75 total carbon, 0.27 to 0.52 combined carbon, 2.62 to 3.22 silicon, 0.98 to 1.18 manganese, 0.60 phosphorus, 0.03 sulphur and 0.02 copper. The mixtures were naturally regulated very carefully with reference to pig and scrap. The percentage of impurities ranged from 7.50 to 8.10 per cent., the iron running 92.475 per cent. on an average. Whenever the percentage of impurities exceeded 8, sending the iron below 92 per cent., the castings would become undesirable, porous and weak. When the impurities reached 9 per cent. and over (I have sometimes had 9.36 per cent., which meant that the iron dropped below 91 per cent.) the castings were unfit for use.

In my estimation the above limits are not absolutely final ones, for circumstances may circumscribe them much more closely. That the quality of the castings must suffer when the percentage of impurities rises is perfectly natural, but even with the same percentage of iron present, as, for instance, 92.475, as given above, or 92.22 per cent., as in another case where the impurities were 7.78, the difficulties may be greatly increased when any particular impurity goes up unduly. For instance, sulphur and copper may be too high, manganese, silicon and carbon too low.

Where the same brand of iron was used continuously and the quality of the castings gradually deteriorated in spite of a proper pig iron composition, the answer was more difficult. The determination of the iron contents finally solved it. This was found to have gradually dropped from 92.475 per cent. down to 91.0 per cent. and even below, and resulted from changes in the furnace burden. It was found that in the hope of improving the pig iron for foundry purposes and getting a specially fine fracture the carbon was brought up to 4 per cent., the silicon from 4.10 to 4.34 per cent., the manganese to 1.23 per cent., phosphorus 0.6 per cent., sulphur 0.055 per cent. and copper from 0.02 to 0.10 per cent.

As I know of pig irons which are sold as among the best and still contain 4 9 per cent. total carbon, silicon 2 to 2.50 per cent., manganese 0.6 to 0.7 per cent., phosphorus 0.94 to 1.20 per cent. and sulphur 0.10

to 0 14 per cent., it is not to be wondered at that the results would be poor. Where the percentage of iron is dropped down to 80.65 per cent., instead of being 92 per cent., castings must be failures. The tendency of German furnaces is to burden the furnace to produce a maximum amount of silicon. The result is a maximum of other things not so desirable, and the complaints heard so often about bad iron are fully justified.

The trouble with furnacemen seems to be the all too frequent practice of using mill cinder in the burden. This, of course, promotes smoother running on the part of the furnace, helps to avoid explosions and cheapens the run. If this slag and cinder be added judiciously it certainly helps the foundrymen, but how few of them exercise the necessary care. My own experience indicates that irons made with the use of plenty ot cinder for washing purposes furnish a foundry pig iron which is unreliable, weak, and of very little value for critical work when compared with the honest pig irons.

From the above remarks we will see that chemical and physical investigations are of great value to the foundry industry and that the same class of investigations are equally necessary at the blast furnace if good results are to follow regularly.

For a proper exchange of opinions and for purposes of record all chemical and physical investigations should be conducted on standard lines. Uniformity in test bars and methods of analysis is very essential not only where simple information is wanted but also for trade purposes. Fortunately Europe and America are working hand in hand in this direction.

If, as it seems, there is a general demand on the part of consumers to get a better grade of castings, be it through an improvement of the cupola product or in the original pig irons used, this demand will have to be satisfied or attention will be turned in a still greater measure to furnace iron and steel castings. A comparison of the analyses mentioned above with those which follow will show this.

Cold blast charcoal iron usually runs 3 to 3.50 per cent. carbon, 0.60 to 2 silicon, 0.40 to 1 manganese, 0.15 to 0.25 phosphorus and 0.02 to 0.04 sulphur, or 4.17 to 6.97 per cent. impurities and 95.83 to 93.21 per cent. iron. Compared with the pig iron discussed in the early part of this paper a marked improvement may be readily seen. Steel castings similarly show only 0.74 to 1.44 per cent. impurities and 99.86 to 98.56 per cent. iron. It is evident that coke irons as now produced show a tendency to slip through altogether too great a percentage of impurities, and indeed America has recognized this fact by an enormous expansion of its steel casting industry.

In closing this article I beg to acknowledge the disinterested kindness and assistance rendered me by the management of the Zawadyki Foundry, by General Manager Esser of the Upper Silesian Railroad Company, and the laboratories of Dr. Carl Heyer in Dessau.

How to Get On in the World.

To shirk a disagreeable task that has to be done, with good will or without; to try to evade the inevitable and postpone necessity; to stand shivering on the brink when the plunge must perforce be made, and the sooner it is made the sooner the shock and its consequences will be over; to waste our strength in fretful anticipations of fatigue, and to substitute dilettanteism for honest work, perfunctoriness for brave endeavor—these ways of living, though too much after the manner of half-hearted men, are the ways which lead to ruin and destruction. It would seem, indeed, as if the chief good of life consists in the steadfastness with which one can buckle to and bear one's burden—buckle to and bear one's load; as if tightening the straps and strengthening the harness itself lessens the strain, and the more closely one stands up to one's work the easier it is to do. Putting off the day of buckling to, hoping for miracles to be wrought in our favor by which that day shall never come at all, praying to the friendly Hercules looking down at us from the clouds to lift our cart from the rut and save our own shoulders from the wheel, are misspent hours and misdirected energies in every way.

It would be more to the purpose to buckle to with a will, and lift that sticking cart by one's own efforts. It can be done, and more—it has to be done; and delay scores nothing to our advantage, but much to our disaster, for sticking carts have the faculty of sinking deeper the longer they stand, and difficulties accumulate by time and delay, till what was once a layer of fiue white sand, and which a feather could brush away, becomes by neglect and lapse of moments a hard and concrete stratum, which not even the unassisted efforts of Hercules himself could break up or remove. Take the case of a man whose affairs are going wrong, and whose books show a perilous inclination. Obviously the duly rational thing for him to do is to buckle to at once, go into his affairs, check his expenditure, cut off his superfluities, and lift his cart from the rut of bankruptcy into which it is fast sinking. But if he has not the energy or common sense necessary for this—if he delays for this hope, for that fear—if now this problematical gain is to be made, that bad debt paid up—if his wife's delicate nerves need management, and the state of her health demand a carriage—if he must strain one point for his son on his entering into life, and another for his daughter on her first season—if shadowy fingers slacken the straps, and the mildew of fallacious hope rusts the buckles—what can there be but irremediable disaster and a general collapse as the result of those insane attempts to shirk a painful task and evade the inevitable? If he had had the courage of his situation, and buckled to at the first, he might have retrieved all that had been lost, and made good his future position. It was simply a question af promptness and daring—of buckling to with a will. But he temporized and delayed, slackened this girth, loosened that strap, let ends fly loose and buckles slip, hoping rather than doing, and looking to that stalwart Hercules in the clouds or on that machine where he thought was hidden the god who would put all things right with a nod of his head, rather than trust to himself, putting his own shoulder to the wheel and buckling to like a Trojan. In consequence when he comes to grief, anyone but himself could see he was foredoomed, and upsets the whole concern into the ditch.

This is one result of that foolish temper which will not accept cheerfully what it cannot avoid by any ingenuity in the world, and which does not reflect that the more closely fitting the harness the easier it is to draw the load. If grumbling at a trouble would lessen and finally disperse it altogether, by all means let it be done; if shifting one's yoke from shoulder to shoulder, and vainly trying to pull it over one's poor long ears, would slacken the strain and finally dissolve the substance, one would be well quit of one's impediment for a litttle abrasion of the epidermis; but when it only chafes and does not slacken, only deepens the sore, and never dissolves the substance, it seems but a poor exercise of energy and ingenuity, and buckling to would be a better employment for all.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Scranton (Pa.) Gas and Water Company have issued a notice that, on and after April 1st, 1901, the net selling rate shall be $1 per 1,000 cubic feet.

MR. WALTER R. LEHMICKE, Secretary and Treasurer of the Hot Springs (Ark.) Electric Light, Water and Gas Company, died suddenly in that city, the morning of the 31st ult.

MR. RANDOLPH KENDALL, of Portland, Me., has been appointed General Manager of the Manchester (Va.) Light, Heat and Power Company.

THE London (England) *Daily Telegraph* said recently: "To steal pence out of a blind man's tray is supposed to be the acme of meanness; but a Battersea man has found a means of rivalling that species of depravity. He deluded the children who lived in his tenement into the idea that the penny-in the-slot gas meter was a new and resplendent bright red money-box specially designed to accommodate the savings of economical youngsters. On this assumption they cheerfully dropped their copper savings into the slot, and the ingenious deceiver burned the gas which cost him nothing. When the collector came and cleared away all the pennies the chagrin of the youthful students of thrift may be imagined."

A CORRESPONDENT in Chester, Pa., forwards the following: "At a special meeting of the Board of Directors of the Delaware County Gas Company, of Chester, the Vice President, Mr. Richard Wetherill, in calling the meeting to order made formal announcement of the death of the President, Capt. W. S. McManus. A resolution, which was offered by Mr. Richmond L. Jones, and seconded by Mr. O. B. Dickinson, noted with the greatest sorrow that in the death of Captain McManus the Company had suffered an irreparable loss; that to his untiring interest and industry the stockholders were largely indebted for the development of the property and the consequent increase in its business; and that to him the public and the Company were positively indebted for the great improvement in the service rendered, thus bringing benefits to the city of Chester that could not be adequately measured. The other members of the Board added oral tributes of

esteem to the worth of deceased, and high testimony of their love and regard for him The resolutions having been unanimously adopted the Board completed the following reorganization: President, Richard Wetherill; Vice-President, O. B. Dickinson. Mr. J. Frank Black was elected to the vacancy on the Board."

MR. ROBERT DABNEY MCCUE, of Stanton, Va., has been appointed Superintendent of the gas division of the Apperson syndicate's properties recently acquired by it at Lynchburg, Va.

THE Dover (N. H.) House of Assembly has passed the bill authorizing the United Gas and Electric Company, of Dover, N.H., to acquire the respective properties of the Berwick Power Company and the Dover Gas Light Company.

AT the annual meeting of the New Britain (Conn.) Gas Company, the Directors elected were: James H. Eddy, A. J. Sloper, G. M. Landers, E. N. Stanley and E. H. Russell—Mr. Landers succeeds the late Mr. F. N. Stanley.

THE new gas plant at Gardner, Mass., is in successful operation.

MR. W. H. CURTIS, for over 18 years in the service of the Haverhill Gas Company, where as Treasurer or head bookkeeper—he filled the latter position since the plant was taken over about 3 years ago by certain capitalists of Newark, N. J.—has resigned. His successor is Mr. P. J. Anderson, of Newark.

THE Township Board of Springwells, Mich., has granted a franchise for the operation of a gas works to Messrs. John P. Cowing and N. F. Bromley, of Cleveland, Ohio, who are also said to control the stock of the projected Gas Company for the not far away city of Wyandotte, Mich. Under the agreement gas is to be sold in Springwells for illuminating purposes at the rate of $1.15 per 1,000 cubic feet, with 15 cents per 1,000 off for prompt payment, the rate on account of fuel use to be 90 cents per 1,000 gross, less 15 cents for prompt payment. It is agreed that work on the plant is to be begun within 6 months, and that the supply will be laid on by March 2, 1902. The ordinance provides for the distribution of a gas up to 17 candle power. Springwells is a township of Wayne County, Mich., and is located on the Detroit river at a point about 3 miles west of Detroit. The tracks of the Michigan Central Railroad pass through Springwells, and the town maintains many manufacturing works. Its population is not less than 10,000, and there can be no doubt whatever that it would well support a gas works.

"R. L", writing to the JOURNAL under date of the 12th inst, incloses the following account of what was done to Mr. Horace A. Allyn, the capable superintendent of the Cambridge (Mass.) Gas Light Company, by his employees the afternoon of the 7th inst.—this action well illustrates the affection and regard in which the lovable Mr. Allyn is held by those whom he directs: "Mr. Allyn, there is a stoppage in the works, and your presence is wanted immediately at the lower end of the yard near the new water gas building." This was the imperative message that soon placed Mr. Horace A. Allyn, Superintendent of the Cambridge Gas Light Company's works, on Third street, in "the hands of his friends," or more to the point, employees, nearly 100 of whom had assembled to apprise him of the fact that a quarter of a century marked the time of his connection with the corporation. This recognition took the substantial form of a handsome solid silver, gold lined, punch bowl and ladle. The inscription on one side was: "Presented to H. A. Allyn, by the employees of the Cambridge Gas Light Company, February 7, 1901, 25 years." Mr. Albert M. Barnes, Treasurer of the Company, made the presentation speech on behalf of the employees. He said: Mr. Allyn for some time past there has been among your employees here at the works a feeling of unrest which may, or may not, have attracted your attention, and this feeling has spread so rapidly and became so universal that the men have finally decided to lay the matter before you, in order that you may take such action as you think best. They have asked me to present their case to you, thinking, I suppose, that I might do so with less bias, or less prejudice, than one of their own number; and while I differ from them in that opinion most decidedly, I feel it my duty, as an officer of the Company, to do all in my power to bring about a proper understanding and pleasant relations between you and your employees. With this much by way of excuse for my part in this matter, I am here, as the mouthpiece of these men, to say that they want you to understand that things must be changed somewhat from now on. They want me to tell you that during all the many years they have been here under you, they have tried to do their duties to the best of their abilities, and they think the time has now come for them to have something to say to you about the way that you, on your part, have acted towards them. They want, furthermore, to say it in such language that you will not be left in doubt as to their meaning. Doubtless this seems to you a strange proceeding, but you know well enough that when emergencies arise in the gas business they must be met promptly and effectively. To come right down to business, the men's case is this:" (Here the men opened ranks and disclosed in their midst the punch bowl standing on a table handsomely decorated and adorned with flowers.) Mr. Barnes then continued: "Mr. Allyn, your employees ask you to accept this from them as a slight token of their regard and esteem and as a feeble expression of their appreciation of what you have done for them, and been to them, during the past 25 years. Take it in the spirit in which it is offered, and use it with the spirit for which it is intended: So shall it always refresh you when weary and cheer you when depressed." Though taken thoroughly by surprise, Mr. Allyn managed to pull himself together and respond. He said:

"Mr. Barnes and Boys: It hardly seems enough to simply say that I thank you. It is perhaps needless to say that I am taken entirely by surprise. When I was requested to come down here, I had no idea that anything unusual was to occur. In the management of the affairs of the Company during the past 25 years I have endeavored to protect the interests not only of the Company but of yours as well. I am often called upon to say and do things which may at the time seem unjust to you. But I can assure you that I have always had the welfare of the working men at heart, and if I have succeeded in gaining your good will and respect, I am more than repaid, and can only add again that I thank you one and all."

IN further connection with the Cambridge Company it might be said that the water gas annex to its plant will be completed about June 1st.

THE reduction in the gas rate at Scranton, Pa., is not favorably regarded by the gentlemen who are pushing along the opposition scheme for that city. The title of the opposition concern is: The Consumers' Gas Company.

MR. JAMES A. RUMRILL has been elected President of the Springfield (Mass.) Gas Light Company, vice Mr. William H. Haile, resigned.

THE proprietors of the Newburyport (Mass.) Gas and Electric Company propose to extend its service to the nearby towns of Newbury and West Newbury.

THERE is very little doubt that Mr. John Martin, who has for some time been in control of the lighting situation at Marysville, Cal., will shortly become the owner of the gas and electric service at Chico, Cal. In fact we believe that he secured control of the Chico Gas Company's properties about a fortnight ago.

ANY electrician out West who thinks that the gas business is decaying is respectfully referred to the last annual report of the Peoples Gas Light and Coke Company, of Chicago. The net earnings of the Company for the year 1900 show a return equal to 7.68 per cent. on its capital stock, which appears to be $28,668,800. The Company paid a 6 per cent. dividend in 1900, added 23 miles length to its street mains, and placed several thousand new meters. The Directors elected at the annual meeting were: Messrs. C. K. G. Billings, F. S. Winston, A. N. Brady, Walton Ferguson and A. R. Flower. Our advices from the meeting are dated the 13th inst., and it is suggested in them that Mr. Billings will not be re elected President of the Company; but our own belief is that he will be found doing business as President after the Directors have had their organization session. [Late news is to the effect that Mr. Knapp has been elected President of the Company, Mr. Billings to act as Chairman of the Advisory Board.]

THE Hon. Fritz H. Twitchell, for many years a controlling spirit in the Bath (Me.) Gas and Electric Company, died in Bath, Me., on the 5th inst. He had been prominent in the political, social and commercial life of Bath since 1880. He was a member of the Bath Common Council for several terms, serving as President thereof for four terms. He was Mayor of Bath in 1891 and 1892, and was a member of the State Assembly in 1893 and 1894. In 1898 he served on the Council to the Governor of the State. He is survived by his wife and one daughter.

THE Board of Aldermen, of Paterson, N. J., in the height of their wisdom, passed, over Mayor Hinchliffe's veto, the franchise permitting the North Jersey Gas Company to do business in the districts now supplied with gas by the Paterson and Passaic Gas and Electric Company.

THE American Bridge Company announces that its New York contracting office will hereafter be in charge of Mr. S. Fischer Miller, formerly with Messrs. Milliken Brothers. The Company has also been awarded a contract for furnishing the steel work to the Bureau of Yards and Docks for building No. 22 at the New York naval yard.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
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MONDAY, FEBRUARY 18, 1901.

The Market for Gas Securities.

There is nothing of moment to chronicle in the state of the local gas share market. As a rule shares are firmly held and the underlying tone naturally is that of strength. There is some diversity of opinion regarding the merits of the Bedell bill, now before the New York Legislature, which has for its object the placing of the gas and electric lighting companies of the State under the guidance of the Board of Railroad Commissioners. Failing a separate commission, it would seem that the measure is sure to be of benefit to the lighting interests concerned. Consolidated closed to-day at 193 to 193½. There is some inquiry for Standard common, and odd lots of Mutual do not long remain untaken. All city gas bonds are strong.

Brooklyn Union is going up, and it will go very much higher. The feature in that Borough this week was the persistent advance in Kings County Electric. We are told that two important interests would like to secure control in it. Peoples, of Chicago, is in good demand, and Lacledes are unchanged. Baltimore Consolidated is 58 to 58½. The general market is strong, with a persistent inquiry for accredited bonds.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEBRUARY 18.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$54,595,200	100	193	193⅛
Central Union, Bonds, 5's.	3,000,000	1,000	108½	109½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	120	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	295	299
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	109½	110
Northern Union, Bonds, 5's.	1,250,000	1,000	104	104¼
New York and East River .. Bonds 1st 5's	3,500,000	1,000	103	106⅜
" 1st Con. 5's	1,500,000	..	115	.
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	130	132
Preferred	5,000,000	100	148	150
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	178	180
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1	1⅛
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works, ..	450,000	100	28	35
" 1st Mtg. 5's	503,000	1,000	96½	99½
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	68	71
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati G. & C. Co.	8,500,000	100	194	198
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	215	216
Consolidated, Baltimore	11,000,000	100	58	58½
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	16
" Con. Mtg. 5's	380,000	1,000	80	85
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	88	89
" Prior Lien 5's	4,737,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	100	101
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	35	40
Fort Wayne	2,000,000	..	35	41
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co..	1,000,000	50	103	105
" 1st Mtg. 5's	1,225,000	1,000	..	..
Hartford	750,000	25	240	250
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	45	50
" Bonds, 6's	2 650,000	..	92	95
Jackson Gas Co	250,000	50	70	75
" 1st Mtg. 5's	265,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	101½	103
Laclede, St. Louis	8,271,000	100	74	76
Preferred	2,500,000	100	97	100
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	40	50
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co.	400,000	100	62	65
" 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1901	100,000	25	87	89
Montreal, Canada	2,000,000	100	183	184¾
Newark, N. J., Con. Gas Co Bonds, 6's	6,000,000	..	..	55
	4,600,000	..	..	103
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	101⅛	102¾x
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	47¾	47⅛
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's.	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's..	2,465,000	1,000	88	90½
St. Joseph Gas Co	1,000,000	100	35	40
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	11¾	14
Bonds	1,612 000	1,000	88½	93
Washington, D. C	2,600,000	20	307½	312½
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	94¾	95½
Bonds, 5's	3,830,500	..	106¼	107½
Wilmington, Del.	600,000	50	200	201

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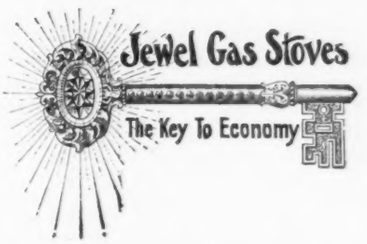

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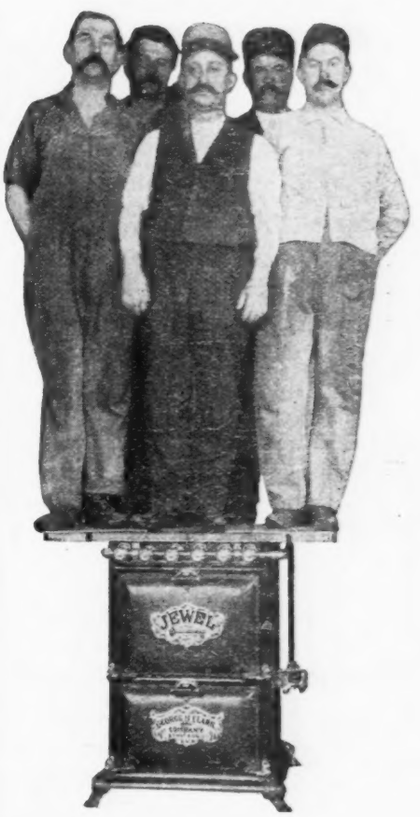

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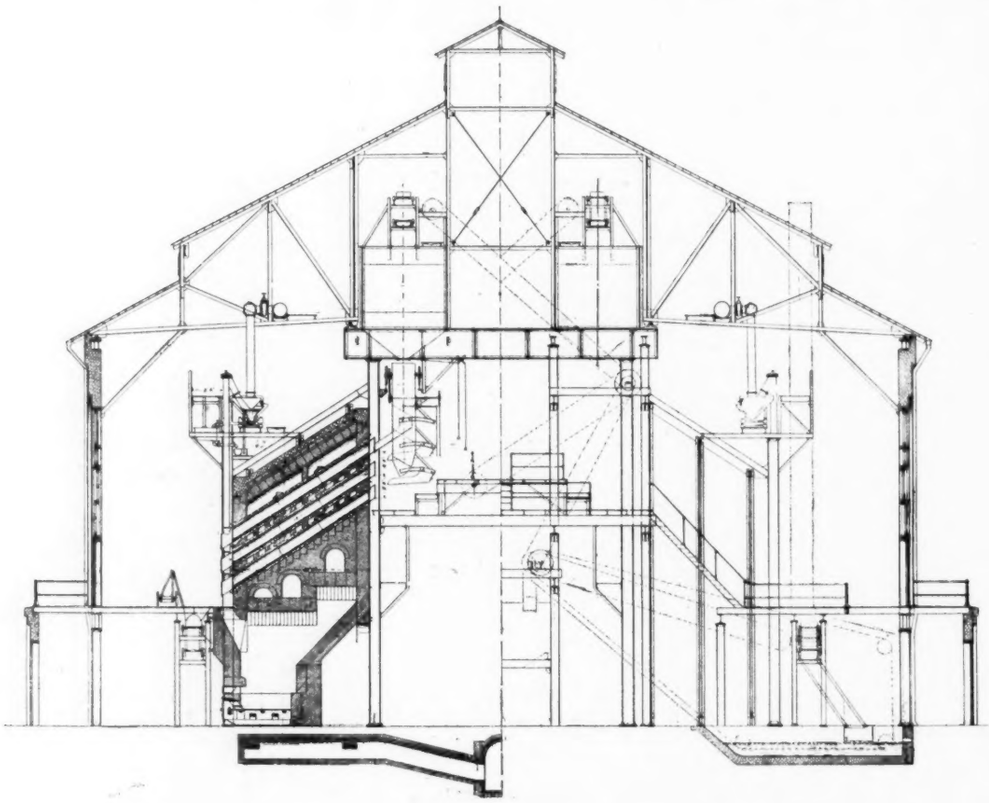

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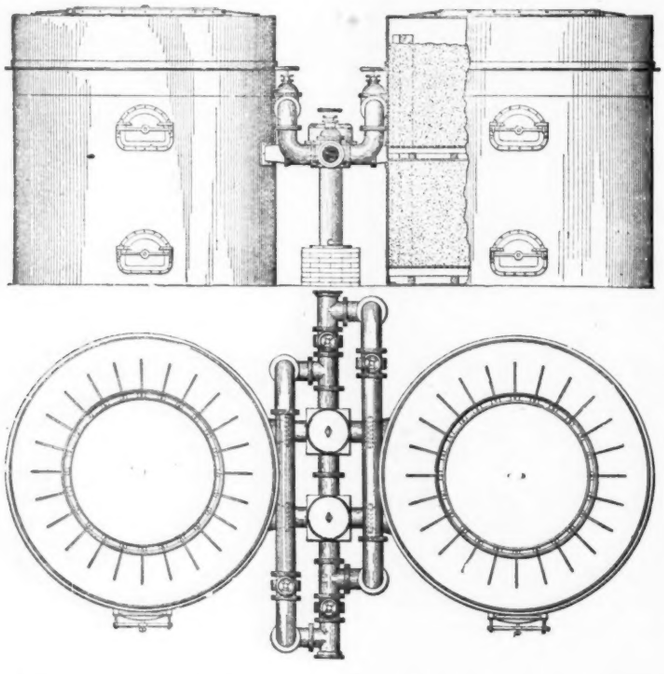

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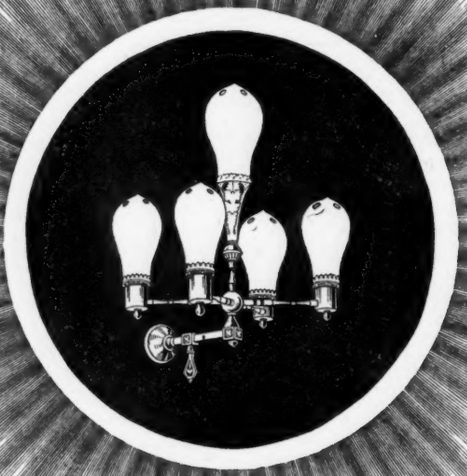

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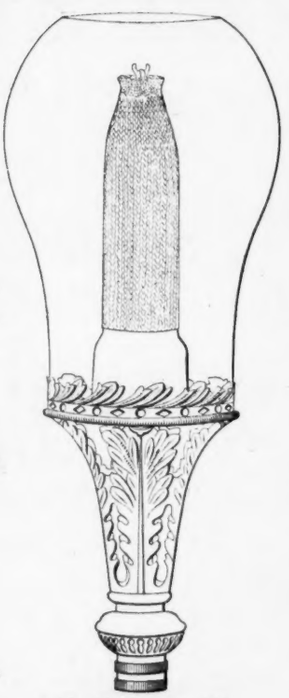

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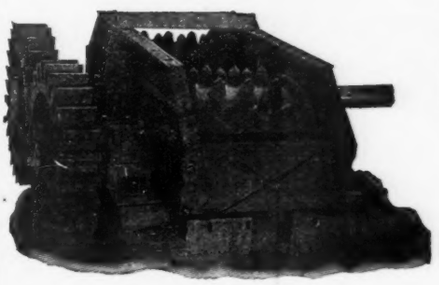

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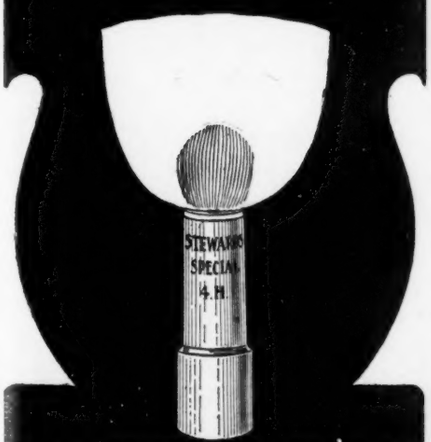

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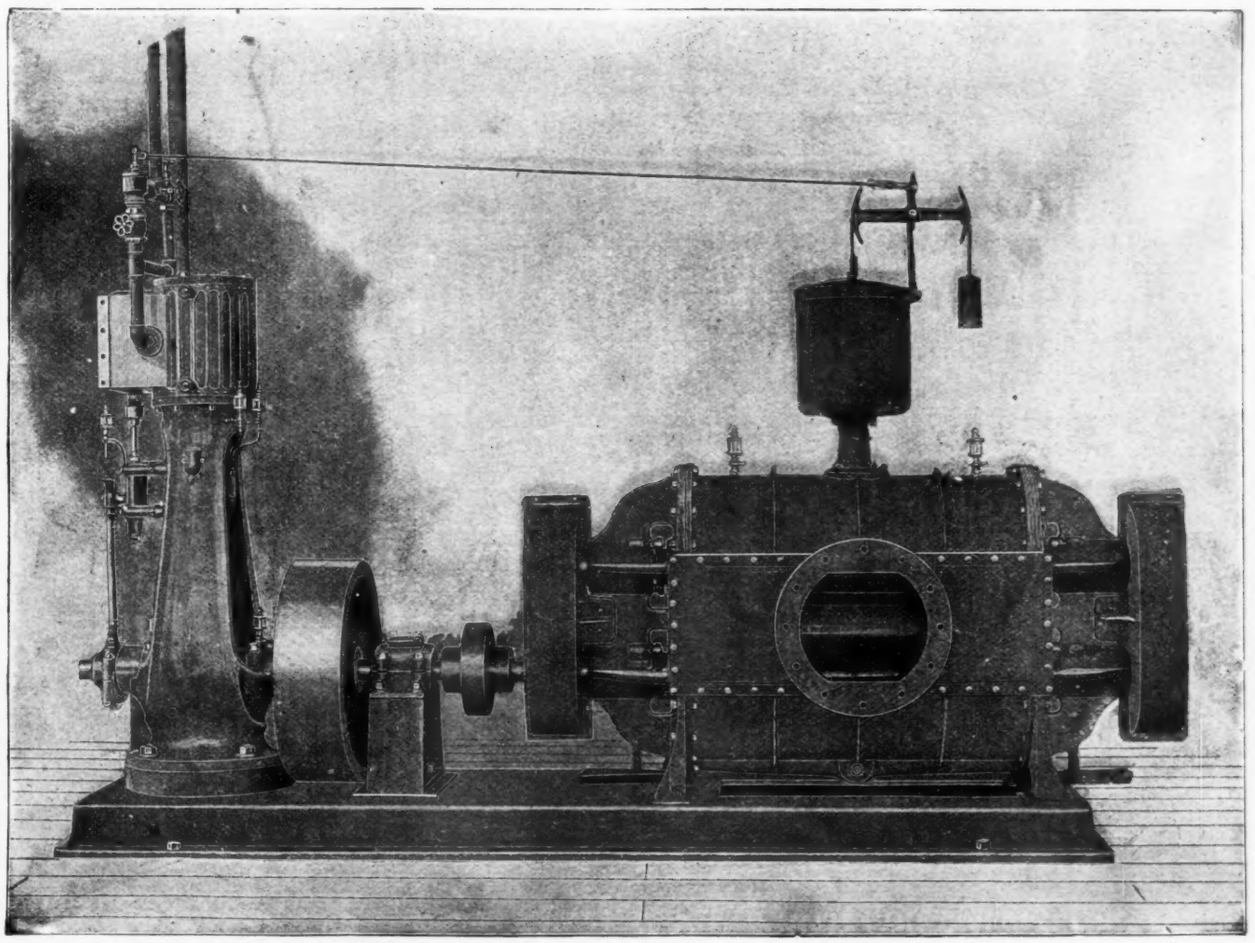

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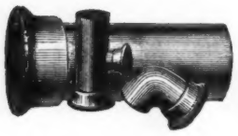

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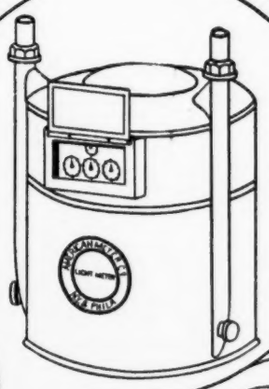

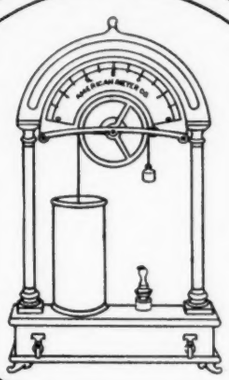

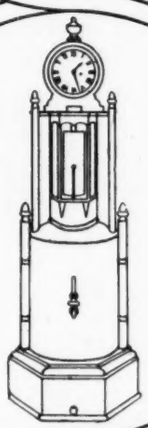

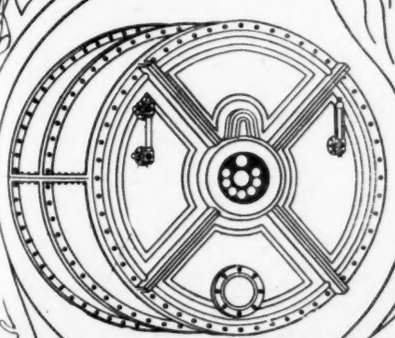

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NEW YORK AND PHILADELPHIA,

CHICAGO, ST. LOUIS,

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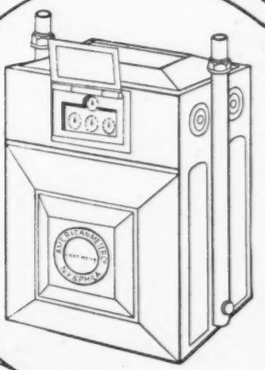
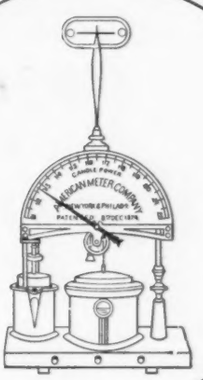
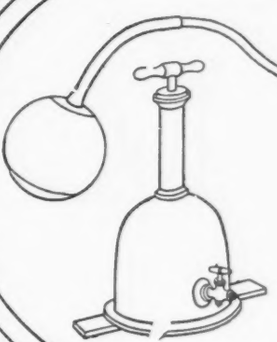
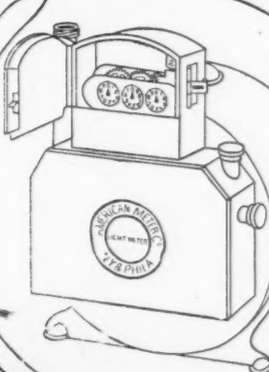








PUBLIC LIGHTING TABLE.

MARCH, 1901.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	3.40 AM	5.40 AM	5.30	5.45
Sat.	2	4.20	5.40	5.30	5.45
Sun.	3	No L.	No L.	5.30	5.45
Mon.	4	No L. FM	No L.	5.30	5.45
Tue.	5	No L.	No L.	5.40	5.35
Wed.	6	6.30 PM	8.30 PM	5.40	5.35
Thu.	7	6.30	9.30	5.40	5.35
Fri.	8	6.30	10.30	5.40	5.35
Sat.	9	6.30	11.20	5.40	5.35
Sun.	10	6.30	12.20 AM	5.40	5.35
Mon.	11	6.30	1.10	5.40	5.35
Tue.	12	6.30	2.00	5.50	5.20
Wed.	13	6.30 LQ	2.50	5.50	5.20
Thu.	14	6 30	3.40	5.50	5.20
Fri.	15	6.30	4.20	5.50	5.20
Sat.	16	6.30	5.00	5 50	5 20
Sun.	17	6.40	5.00	5.50	5.20
Mon.	18	6.40	5.00	5.50	5.20
Tue.	19	4.40	5.00	6.00	5.10
Wed.	20	6.40 NM	5.00	6.00	5.10
Thu.	21	6.40	5.00	6.00	5.10
Fri.	22	6.40	5.00	6.00	5.10
Sat.	23	6.40	5.00	6.00	5.10
Sun.	24	6.50	4.50	6.00	5.10
Mon.	25	11.30	4.50	6.00	5.10
Tue.	26	12.20 AM FQ	4.50	6.10	4.55
Wed.	27	1.10	4.50	6.10	4.55
Thu.	28	1.40	4.50	6.10	4.55
Fri.	29	2.20	4 50	6.10	4.55
Sat.	30	2.50	4.50	6.10	4.55
Sun.	31	3.20	4.50	6.10	4.55

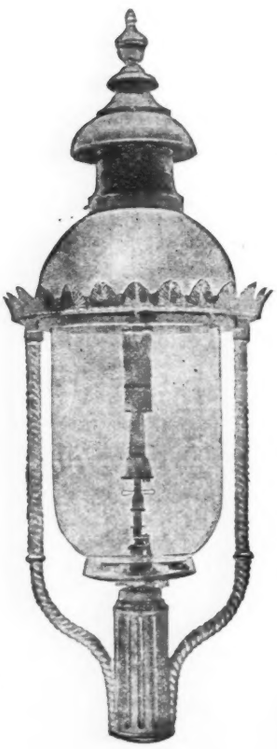
TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45

NEW YORK, 33 Nassau St. PHILADELPHIA, Broad and Arch Sts. CHICAGO, 54 Lake St.

Welsbach Street Lighting Company

.... OF AMERICA ....



No. 36.

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Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

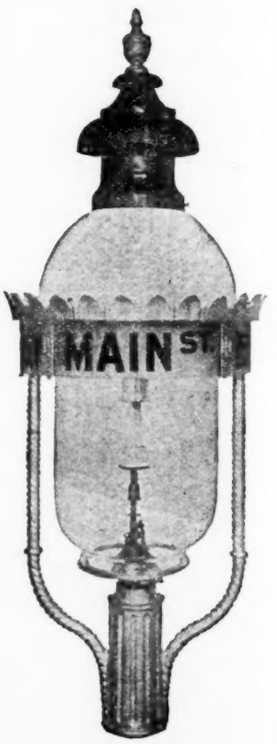
By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



No. 38.

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Welsbach Famous Mantles.

THE INCOMPARABLE

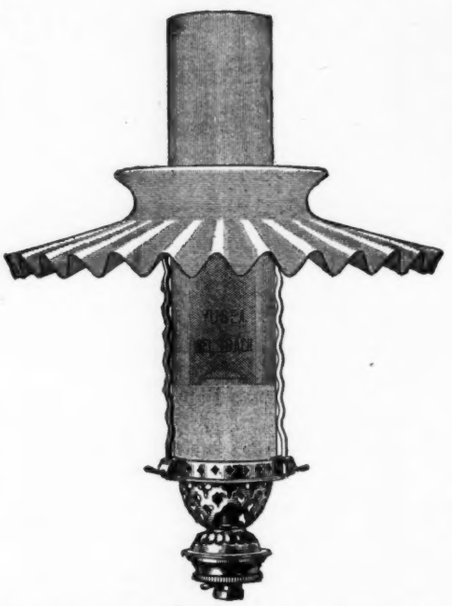
"Yusea" Welsbach Mantle

FINEST EXAMPLE

OF INCANDESCENT

GAS LIGHT

EVER EXHIBITED.



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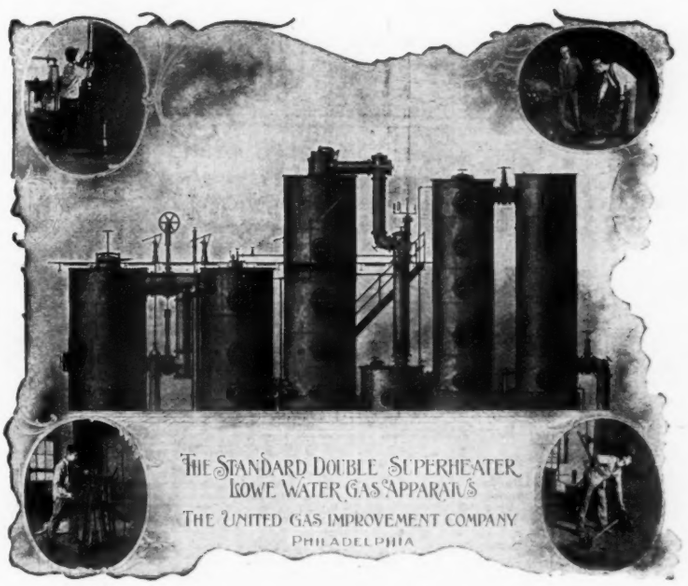
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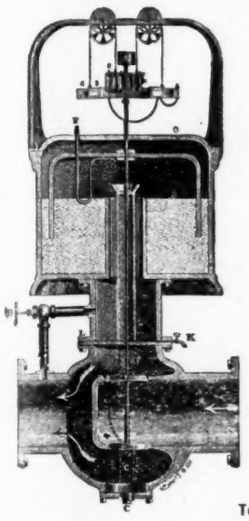

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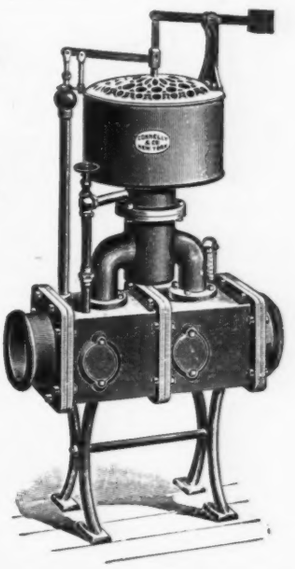

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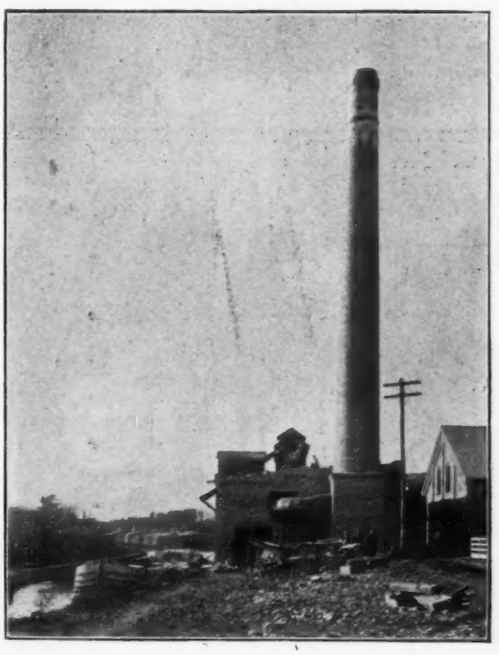

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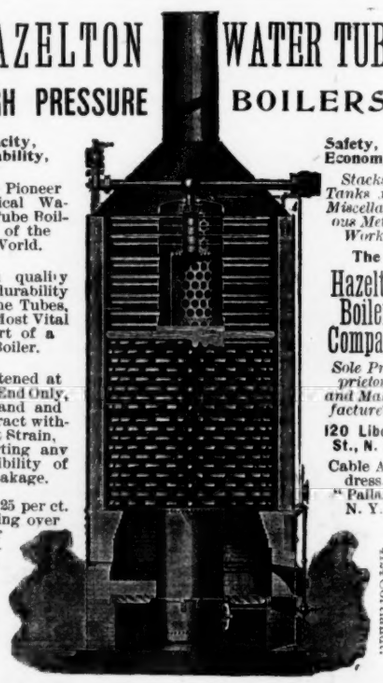

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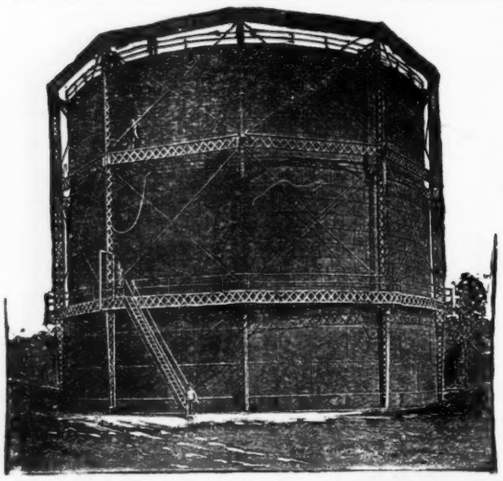

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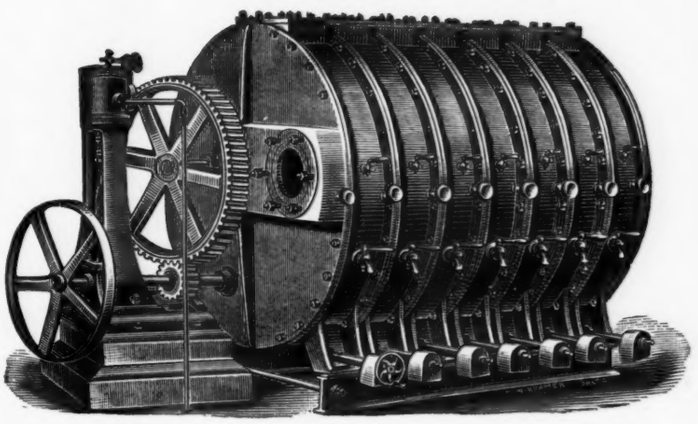

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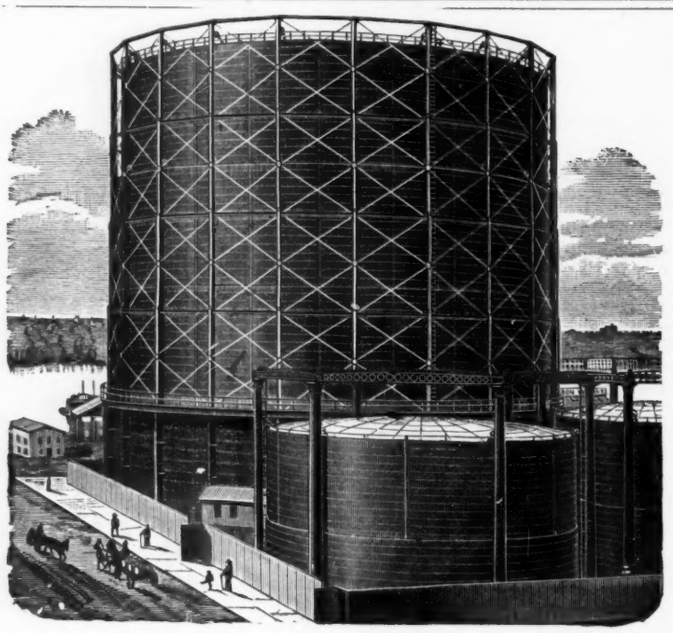

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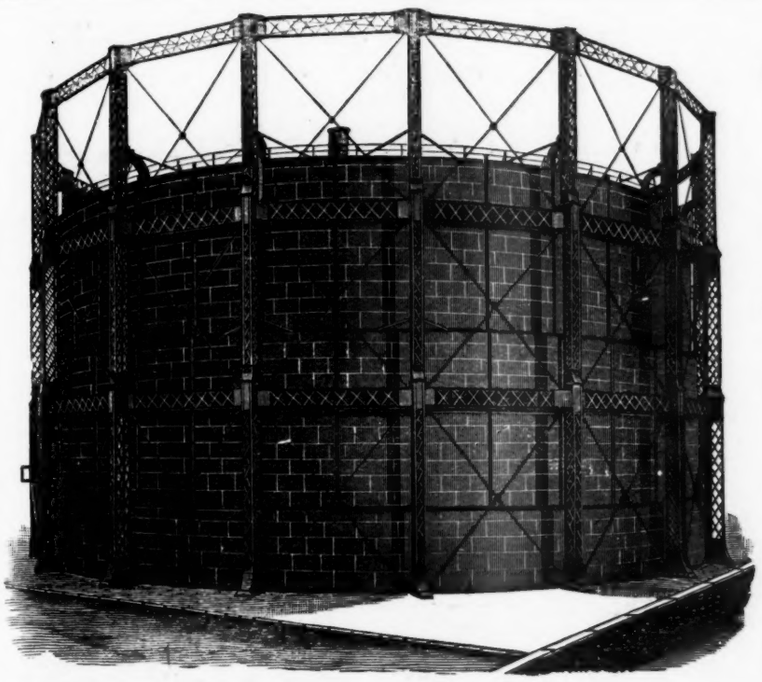

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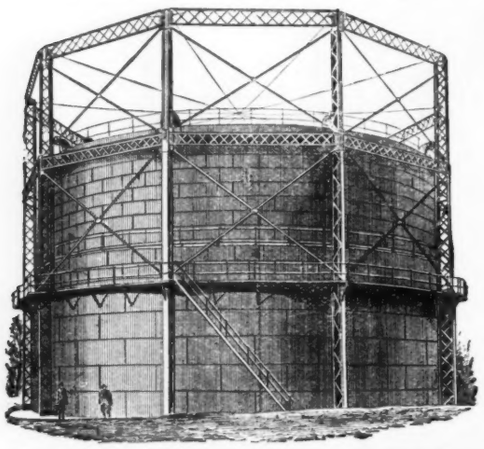

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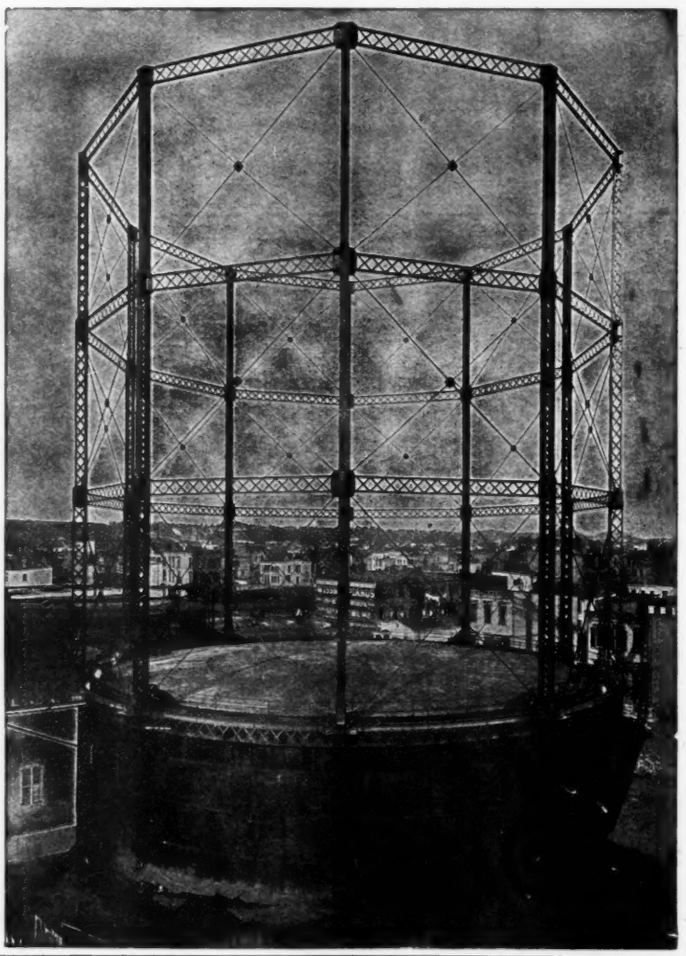

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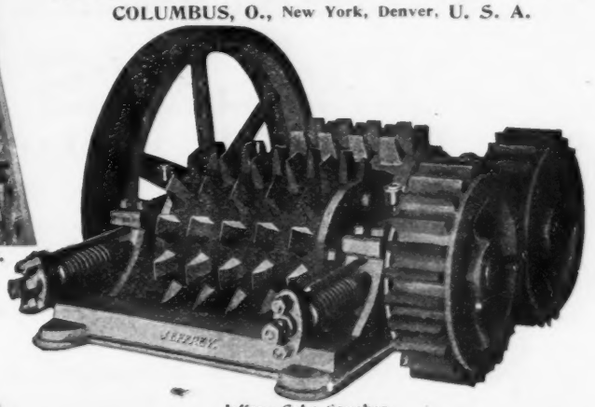

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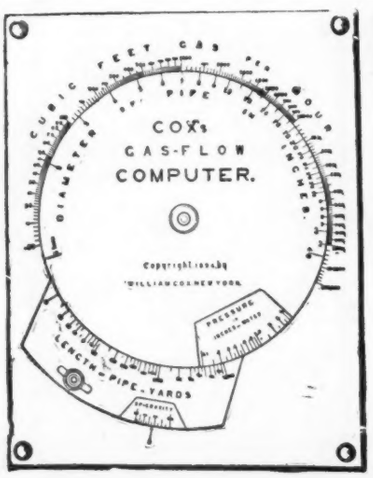

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